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NRC · CNRC

Report on Plans and Priorities

National Research Council Canada

2008-2009
Estimates

Jim Prentice
Minister of Industry

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ACRONYMS AND ABBREVIATIONS

AAFC	Agriculture and Agri-Food Canada
ACAMP	Alberta Centre for Advanced MicroNano Technology Products
ACC	Atlantic Commercialization Centre
ACURA	Association of Canadian Universities for Research in Astronomy
AFFORD	Alternative Fuels Facility for Research & Development
AIP	Atlantic Investment Partnership
ALMA	Atacama Large Millimetre Array
BDC	Business Development Bank of Canada
CBRN	Chemical, Biological, Radiation and Nuclear
cGMP	Current Good Manufacturing Practices
CFIA	Canadian Food Inspection Agency
CFHT	Canada-France-Hawaii Telescope
CNCB	Canadian Neutron Beam Centre
CRTI	CBRN Research and Technology Initiative
CSA	Canadian Space Agency
CTI	Competitive Technology Intelligence
DRDC	Defence Research and Development Canada
FCHP	Fuel Cell and Hydrogen Program
FCRC	Fuel Cell Research Centre
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
GERD	Gross Expenditures in Research and Development
GHI	Genomics and Health Initiative
GPS	Global Positioning System
HRM	Human Resources Management
ICT	Information and Communications Technologies
IMRIS	Innovative Magnetic Resonance Imaging Systems
IP	Intellectual Property
IPF	Industry Partnership Facility
JCMT	James Clerk Maxwell Telescope
JWST	James Webb Space Telescope
LRP	Long Range Plan for Astronomy and Astrophysics
LTRC	Language Technologies Research Center
MRI	Magnetic Resonance Imaging
MRS	Major Resource Support
MSE	Medium-Sized Enterprise
MUHC	McGill University Health Centre
NIC	NRC Information Centre (NRC-CISTI)
NINT	National Institute for Nanotechnology
NMI	National Metrology Institute
NRC	National Research Council Canada
NRC-AMTC	NRC Aerospace Manufacturing Technology Centre
NRC-ATC	NRC Aluminium Technology Centre
NRC-BRI	NRC Biotechnology Research Institute

NRC-CB	NRC Commercialization Branch
NRC-CHC	NRC Canadian Hydraulics Centre
NRC-CISTI	NRC Canada Institute for Scientific and Technical Information
NRC-CPFC	NRC Canadian Photonics Fabrication Centre
NRC-CSIR	NRC Centre for Sustainable Infrastructure Research
NRC-CSTT	NRC Centre for Surface Transportation Technology
NRC-GTL	NRC Gas Turbine Laboratory
NRC-HIA	NRC Herzberg Institute of Astrophysics
NRC-IAR	NRC Institute for Aerospace Research
NRC-IBD	NRC Institute for Biodiagnostics
NRC-IBS	NRC Institute for Biological Sciences
NRC-ICPET	NRC Institute for Chemical Process and Environmental Technology
NRC-IFCI	NRC Institute for Fuel Cell Innovation
NRC-IIT	NRC Institute for Information Technology
NRC-IMB	NRC Institute for Marine Biosciences
NRC-IMI	NRC Industrial Materials Institute
NRC-IMS	NRC Institute for Microstructural Sciences
NRC-INMS	NRC Institute for National Measurement Standards
NRC-INH	NRC Institute for Nutrisciences and Health
NRC-IOT	NRC Institute for Ocean Technology
NRC-IRAP	NRC Industrial Research Assistance Program
NRC-IRC	NRC Institute for Research in Construction
NRC-PBI	NRC Plant Biotechnology Institute
NRC-SIMS	NRC Steacie Institute for Molecular Sciences
NRCan	Natural Resources Canada
NSERC	Natural Sciences and Engineering Research Council of Canada
OAG	Office of the Auditor General of Canada
OAP	Oceans Action Plan
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
OPO	Ocean Science and Technology Partnership
OTEC	Ocean Technology Enterprise Centre
PAA	Program Activity Architecture
PEMFC	Polymer Electrolyte Membrane Fuel Cells
PERD	Program for Energy Research and Development
PSST	Public Security Science and Technology
R&D	Research and Development
RMSA	Research Management Self-Assessment
S&T	Science and Technology
SMEs	Small and Medium-sized Enterprises
SOFC	Solid Oxide Fuel Cells
STM	Scientific, Technical and Medical
TBS	Treasury Board of Canada Secretariat
TIS	Technology and Industry Support
TRIUMF	Tri-University Meson Facility

Minister's Message

The Government of Canada is committed to creating an environment where all Canadians have every opportunity for continued prosperity.

We laid out our long-term economic plan in *Advantage Canada*. It identified five Canadian objectives, related to tax reduction, debt reduction, entrepreneurship, knowledge in the workforce and infrastructure, which will help us improve our quality of life and succeed on the world stage. I'm pleased to note the commonality between these advantages and Industry Canada's mission of fostering a growing, competitive, knowledge-based economy.

Clearly, our government is making strides towards achieving our long-term goals. For example, we have provided $190 billion in broad-based tax relief over this and the next five years, including cuts to corporate, small business and personal taxes. Our debt repayment goals have been accelerated by three years. We're setting the right conditions for entrepreneurs to thrive, for research and development to flourish, for additional competition and growth in the wireless sector and for our workforce to build on its expertise. Finally, we continue to invest heavily in our physical infrastructure to build the networks needed to carry our people, goods and services across Canada and beyond.

In May 2007 Prime Minister Harper unveiled our Science and Technology Strategy, *Mobilizing Science and Technology to Canada's Advantage*. It is a policy framework that has received wide acclaim, both in Canada and internationally. Our government believes that science and technology, and research and development, are more critical than ever to pushing forward the frontiers of knowledge and transforming that knowledge into new products, services and technologies.

Our hard work is paying off. The economic fundamentals are in place to help us realize our goals. We boast strong public finances, an economy that is as healthy as it has been for a generation and low unemployment.

As Minister of Industry, I look forward to implementing our government's agenda for providing effective economic leadership — an agenda that provides concrete, realistic solutions to the economic challenges our country is facing.

As always, we must build on our success as a nation. In this regard, Industry Canada and its portfolio partners continue to strive towards a fair, efficient and competitive marketplace, an innovative economy, competitive industries and sustainable communities — in short, outcomes that will help Canadians continue to enjoy a quality of life that is second to none.

It gives me great pleasure to present the annual *Report on Plans and Priorities* for (organization), outlining in greater detail the Department's main initiatives, priorities and expected outcomes for the upcoming year.

Jim Prentice
Minister of Industry

Management Representation Statement

I submit for tabling in Parliament, the 2008-09 Report on Plans and Priorities (RPP) for the National Research Council Canada.

This document has been prepared based on the reporting principles contained in the *Guide to the Preparation of Part III of the 2008-09 Estimates: Reports on Plans and Priorities and Departmental Performance Reports:*

- It adheres to the specific reporting requirements outlined in the Treasury Board of Canada Secretariat guidance;
- It is based on the department's Strategic Outcomes and Program Activity Architecture that were approved by the Treasury Board;
- It presents consistent, comprehensive, balanced and reliable information;
- It provides a basis of accountability for the results achieved with the resources and authorities entrusted to it; and
- It reports finances based on approved planned spending numbers from the Treasury Board of Canada Secretariat.

Name: _____

Title: President

Raison d'être

NRC is the Government of Canada's leading resource for science and technology (S&T) and innovation with a business focus on:

- improving the social and economic well-being of Canadians;
- fostering industrial and community innovation and growth through technology and industry support; and
- supplying excellence and leadership in research and development (R&D).

Organizational Information

NRC Mandate

Under the National Research Council Act, NRC is responsible for:

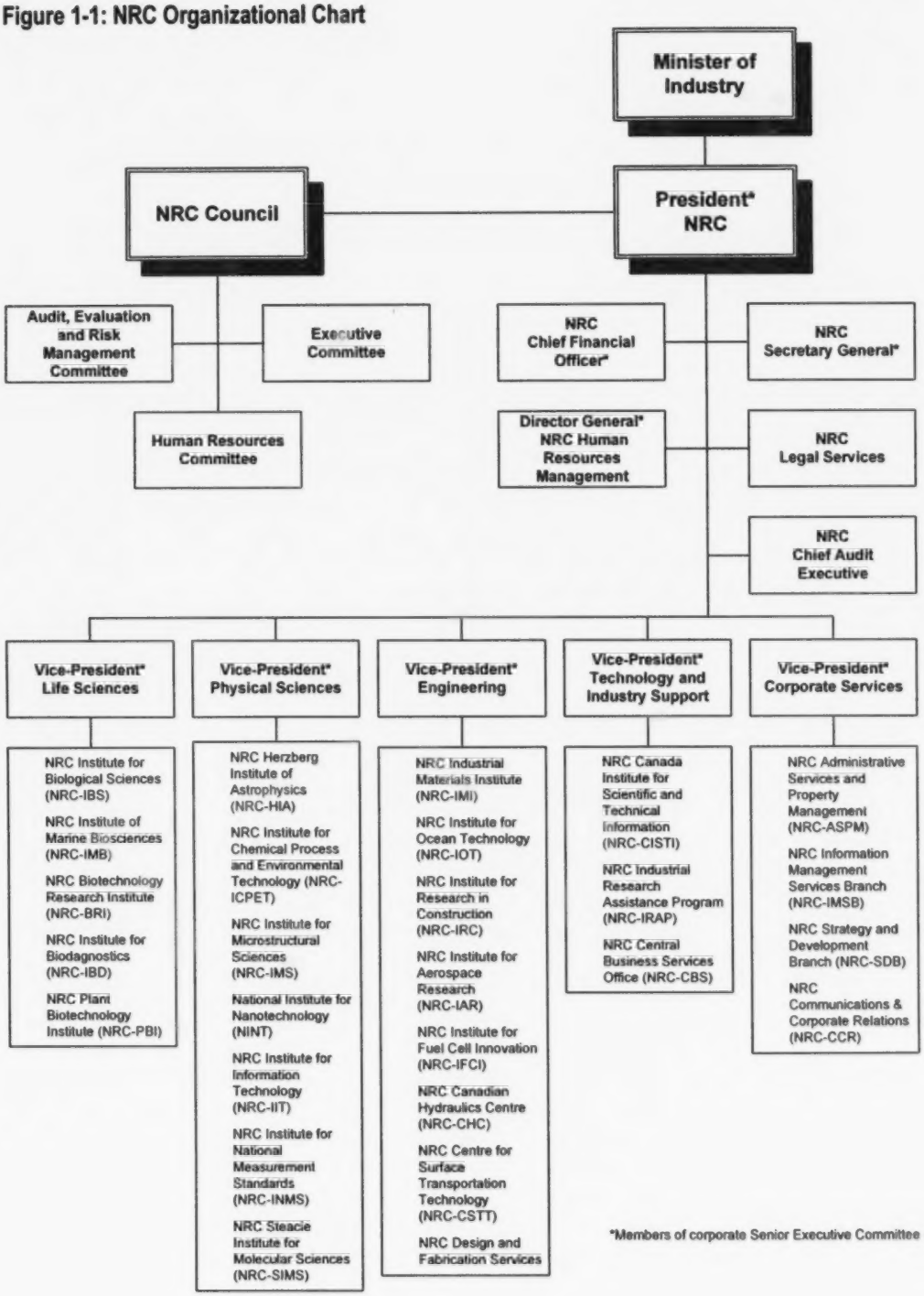
- Undertaking, assisting or promoting scientific and industrial research in different fields of importance to Canada.
- Establishing, operating and maintaining a national science library.
- Publishing and selling or otherwise distributing such scientific and technical information as the Council deems necessary.
- Investigating standards and methods of measurement.
- Working on the standardization and certification of scientific and technical apparatus and instruments and materials used or usable by Canadian industry.
- Operating and administering any astronomical observatories established or maintained by the Government of Canada.
- Administering NRC's research and development activities, including grants and contributions used to support a number of international activities.
- Providing vital scientific and technological services to the research and industrial communities.

Consult http://laws.justice.gc.ca/en/showtdm/cs/N-15 for more details about NRC's legislative framework.

NRC Accountability Framework

NRC is a departmental corporation of the Government of Canada, reporting to Parliament through the Minister of Industry. NRC works in partnership with the members of the Industry Portfolio to leverage complementary resources and exploit synergies in areas such as innovation of firms through S&T, growth of small and medium-sized firms (SMEs) and economic growth of Canadian communities. The NRC Council provides strategic direction and advice to the President and reviews organizational performance. The President is the leader, responsible for fulfilling corporate strategies and delivering results. Five Vice Presidents (Life Sciences, Physical Sciences, Engineering, Technology and Industry Support and Corporate Services) are responsible for a portfolio of research institutes, programs, and centres. Figure 1-1, provides an overview of NRC's organization.

Figure 1-1: NRC Organizational Chart


Minister of Industry
NRC Council
President* NRC
Audit, Evaluation and Risk Management Committee
Executive Committee
Human Resources Committee
NRC Chief Financial Officer*
NRC Secretary General*
Director General* NRC Human Resources Management
NRC Legal Services
NRC Chief Audit Executive
Vice-President* Life Sciences
Vice-President* Physical Sciences
Vice-President* Engineering
Vice-President* Technology and Industry Support
Vice-President* Corporate Services
NRC Institute for Biological Sciences (NRC-IBS)
NRC Institute of Marine Biosciences (NRC-IMB)
NRC Biotechnology Research Institute (NRC-BRI)
NRC Institute for Biodiagnostics (NRC-IBD)
NRC Plant Biotechnology Institute (NRC-PBI)
NRC Herzberg Institute of Astrophysics (NRC-HIA)
NRC Institute for Chemical Process and Environmental Technology (NRC-ICPET)
NRC Institute for Microstructural Sciences (NRC-IMS)
National Institute for Nanotechnology (NINT)
NRC Institute for Information Technology (NRC-IIT)
NRC Institute for National Measurement Standards (NRC-INMS)
NRC Steacie Institute for Molecular Sciences (NRC-SIMS)
NRC Industrial Materials Institute (NRC-IMI)
NRC Institute for Ocean Technology (NRC-IOT)
NRC Institute for Research in Construction (NRC-IRC)
NRC Institute for Aerospace Research (NRC-IAR)
NRC Institute for Fuel Cell Innovation (NRC-IFCI)
NRC Canadian Hydraulics Centre (NRC-CHC)
NRC Centre for Surface Transportation Technology (NRC-CSTT)
NRC Design and Fabrication Services
NRC Canada Institute for Scientific and Technical Information (NRC-CISTI)
NRC Industrial Research Assistance Program (NRC-IRAP)
NRC Central Business Services Office (NRC-CBS)
NRC Administrative Services and Property Management (NRC-ASPM)
NRC Information Management Services Branch (NRC-IMSB)
NRC Strategy and Development Branch (NRC-SDB)
NRC Communications & Corporate Relations (NRC-CCR)
*Members of corporate Senior Executive Committee

Voted and Statutory Items displayed in the Main Estimates

Table 1-1

Vote or Statutory Item	Truncated Vote or Statutory Wording	**Current Main Estimates**	Previous Main Estimates
55	Operating expenditures	**385.5**	365.7
60	Capital expenditures	**39.7**	41.3
65	Grants and contributions	**143.6**	144.0
(S)	Contributions to employee benefits plans	**46.0**	46.2
(S)	Spending of revenues pursuant to paragraph 5(1)(e) of the *National Research Council Act*	**83.5**	75.4
	Total Agency	**698.3**	672.5

Note: Due to rounding, figures may not add to total shown.

Budgetary/ ($ millions)			Loans, Investments and Advances ($ millions)		
2007-2008	2008-2009	Net Increase/(Decrease)	2007-2008	2008-2009	Net Increase/ (Decrease)
672.5	698.3	25.7	-	-	-

Explanation of Major Changes

The Main Estimates for the National Research Council are $698.3 million, a net increase of $25.7 million. The major changes are as follows:

Increase of $25.7 million in budgetary spending due to:

Operating $27.7 million:

- An increase of $33.5M related to the Central & Western Technology Cluster Initiative
- An increase of $8.1M related to the change in forecast for statutory revenue
- An increase of $1.6M for salaries and benefits related to collective agreements
- A decrease of $6.0M related to the sun-setting of the Biotechnology Budget 99 Genomics Initiative.
- A decrease of $6.0M for the sun-setting of the funding for Technology Clusters (Regina/PEI/Alma). NRC received $50M over the five year period starting in 2003-2004 for leading edge technologies and to expand NRC's regional innovation and technology cluster initiatives.
- A decrease (technical adjustment) of $3.0M to the Employee Benefit Plan
- A net reduction of $0.5 M for various initiatives less than $1M.

Capital $(1.6) million:

- An increase of $4.0M related to the Central & Western Technology Cluster Initiative
- A reduction of $4.0M relating to the transfer from Canada Economic Development for equipment and for the technology centre. Last transfer was in fiscal 2007-2008
- A reduction of $1.2M for the Technology Clusters Budget 2003 Initiative.
- A reduction of $0.4M for various initiatives less than $1.0M.

Transfer Payment – Contributions & Other $(0.4) million

- An increase of $2.1M related to the Central & Western Technology Cluster Initiative.
- A net reduction of $1.8M for the TRIUMF initiative
- A reduction of $0.7M for various initiatives less than $1M.

Departmental Planned Spending Table and Full-Time Equivalents

Table 1-2

($ millions)	Forecast Spending 2007-2008[1]	**Planned Spending 2008-2009**	Planned Spending 2009-2010	Planned Spending 2010-2011
Research and Development	459.5	**475.9**	474.9	396.0
Technology and Industry Support	212.9	**222.4**	217.3	209.9
Budgetary Main Estimates (gross)	672.5	**698.3**	692.2	605.9
Non-Budgetary Main Estimates (gross)				
Less: Respendable revenue				
Total Main Estimates	672.5	**698.3**	692.2	605.9
Adjustments:[2]				
Supplementary Estimates				
Renewal of NRC's Central and Western Cluster Initiatives (Round II – Phase 2)	36.0			
Tri-University Meson Fund (TRIUMF)	6.2			
Capital Carry Forward	1.0	**2.1**		
Model National Energy Code of Canada	0.6			
DSM Lease	0.2			
Federal Accountability Act	0.2			
Transfer from DND for Chemical, Biological, Radiological and Nuclear Research & Technology Initiative	0.0			
Collective Bargaining - TB Vote 15	11.0			
Operating Budget Carry Forward - TB Vote 22	19.7			
Pay List Items – TB Vote 23	10.4			
Total Adjustments[2]	*85.2*	**2.1**		
Total Planned Spending	757.7	**700.4**	692.2	605.9
Total planned Spending				
Less: Spending of Revenues Pursuant to section 5(1)(e) of the NRC Act	75.4	**83.5**	79.0	79.0
Plus: Cost of services received without charge	23.1	**26.3**	26.3	26.3
Total Departmental Spending	705.4	**643.2**	639.5	553.1
Full time Equivalents	4,044	**4,331**	4,293	3,893

Note: Due to rounding, figures may not add to total shown

[1] Reflects best forecast of total planned spending to the end of the fiscal year.

[2] Adjustments are to accommodate approvals obtained since the Main Estimates and are to include Budget, Initiatives, Supplementary Estimates, etc.

Summary Information

Table 1-3: Financial Resources ($ millions)

2008-2009	2009-2010	2010-2011
700.4	692.2	605.9

Table 1-4: Human Resources

2008-2009	2009-2010	2010-2011
4,331	4,293	3,893

Table 1-5: Departmental Priorities

Name	Type
1. R&D in Key Sectors and Areas Critical to Canada's Future	Ongoing
2. Community Technology Clustering Initiatives	Previously committed
3. TIS Technology and Industry Support – Integrated Industry Support that Engages Key Players	Ongoing
4. Program Management for a Sustainable Organization	Ongoing

Program Activities by Strategic Outcomes

Table 1-6

Strategic Outcome: An innovative, knowledge-based economy for Canada through research and development, technology commercialization and industry support		**Planned spending ($ millions)**			**Contributes to**
Program Activity	**Expected results**	**2008-2009**	**2009-2010**	**2010-2011**	
Research and Development	• Excellence and leadership in research that benefits Canadians • Contribution to federal strategies and initiatives • Collaborative research with other innovation players nationally and internationally • Greater productivity and increased new technology-based solutions	478.0	474.9	396.0	Priority 1 and Priority 2
Technology and Industry Support	• Improved dissemination of knowledge • Enhanced innovation capacity of firms • Supporting Canadian industry and advancement of new technology-based companies	222.4	217.3	209.9	Priority 3

Plans and Priorities

Mobilizing Science and Technology to Canada's Advantage through NRC

NRC is moving forward with an important role in helping to achieve the goals of the Government of Canada's Science and Technology Strategy, Mobilizing Science and Technology to Canada's Advantage, announced by the Prime Minister in May 2007. The new federal S&T Strategy sets out a multi-year framework to create a competitive advantage for Canada through S&T. It focuses on the principles of promoting world-class excellence, focusing on priorities, fostering partnerships and enhancing accountability. It sets out a plan to foster three distinct S&T advantages for Canada:

- **Entrepreneurial Advantage** – translating knowledge into commercial applications for greater wealth generation and quality of life;
- **Knowledge Advantage** – being at the leading edge of important developments that generate health, environmental, societal and economic benefits;
- **People Advantage** – attracting highly skilled people and educated people for a flexible workforce that can compete globally.

NRC's own Strategy to 2011, *Science at Work for Canada*, is consistent with these principles and objectives, and establishes NRC as an important vehicle to help deliver on the new federal S&T Strategy. NRC is enhancing Canada's Entrepreneurial Advantage by meeting the needs of industry for targeted research and by transferring its discoveries to the private sector. To support Canada's Knowledge Advantage, NRC is strategically contributing to the four research priority areas identified in the federal S&T Strategy: environmental science and technologies; natural resources and energy; health and related life sciences and technologies; and information and communication technologies (ICT). NRC will anticipate and respond to important national priorities by engaging innovation system participants in multi-stakeholder collaborations and developing key competencies that will prepare NRC to support Canada's current and future S&T priorities. Lastly, but critically important, NRC is supporting the People Advantage, by attracting and retaining highly-skilled workers needed to thrive in a global economy. Through establishing entities such as the National Institute for Nanotechnology (NINT) and the NRC Institute for Nutrisciences and Health (NRC-INH), for example, NRC is helping to build strong multidisciplinary teams of international calibre researchers to deliver leading-edge work for Canada.

From an operational perspective, NRC will continue to explore ways to sustain its asset base - 186 buildings totalling approximately 5.6 million square feet of space in the face of annual inflationary pressures, aging buildings and equipment and a static core budget. NRC has the demonstrated capacity to manage its own highly technical and complex operations. The organization will also focus on strengthening its management systems and financial base for future sustainability. This will include continuing to address recommendations made by the Office of the Auditor General of Canada (OAG). NRC prides itself on being an adaptable, flexible organization. These attributes will be particularly important in the years ahead as NRC strives to deliver the best results possible for Canadians.

NRC Operating Environment

NRC has unique attributes that support the three Advantages in the federal S&T Strategy and shape its operating environment, including:

Entrepreneurial Advantage

- The ability to help companies move from discoveries in the laboratory to the development, prototyping, and commercialization of these ideas and technologies for the global marketplace.
- The ability to put together national programs for delivery in regions across the country.
- A national S&T infrastructure positioned to improve Canada's innovation capacity in existing and emerging fields of research by building networks for researchers and businesses, training highly qualified personnel, creating new technology-based companies and jobs, and transferring knowledge and technology to Canadian companies.
- The capacity to adopt an integrated approach that brings research, technologies and industrial links together in delivering its mandate to provide access to international S&T infrastructures.

Knowledge Advantage

- Leading-edge knowledge generation capability – in 2006-2007 alone, NRC published 1,403 articles in refereed journals, presented 870 papers at S&T conferences, and issued 1,239 technical reports.
- The capability to bring together multi-disciplinary research teams to tackle issues of national importance.
- The skills to manage research projects towards specific outcomes as well as long-term goals.

People Advantage

- A core strength of over 4,000 talented and dedicated people housed in 19 research institutes 18 industrial partnership facilities, the NRC Industrial Research Assistance Program (NRC-IRAP), the NRC Canada Institute for Scientific and Technical Information (NRC-CISTI) and two technology centres. In 2006-2007, NRC researchers:
  - received 83 external awards
  - held 217 positions on editorial boards of scientific publications
  - were active in 110 national and international research networks
  - hosted over 1,273 students, postdoctoral fellows and research associates
  - engaged in 361 Canadian and 99 newly signed international collaborative agreements.

Priority 1: R&D in Key Sectors and Areas Critical to Canada's Future

Research and innovation are critical to Canada's future economic growth and an improved quality of life for Canadians. As Canada's foremost R&D agency, NRC concentrates its efforts on two vital elements of R&D excellence: quality and relevance. Creating value from knowledge, providing a national S&T infrastructure, maintaining and fostering international alliances and supporting the commercialization of federal R&D are integral parts of NRC's business. For the planning period, NRC will play a key role in helping Canada reach its full potential by performing research in fields that align with the federal S&T Strategy. To achieve this, NRC will work in collaboration with industry, university and government partners in Canada and abroad.

For example, NRC will continue to work toward the implementation of a plan developed with Natural Sciences and Engineering Research Council of Canada (NSERC) and Business Development Bank of Canada (BDC) to deliver upon a specific commitment of the federal S&T Strategy – the alignment of these three organizations' programs and activities in support of commercialization of research. This joint initiative is focusing on application-oriented projects that: build on technology development-driven and application-oriented research; include active participation from Canadian-based industrial partners or an expression of interest from companies that intend to evaluate and/or exploit the resulting technology; and contain well-defined objectives, which ensure the research results will be achievable within a three-year time frame. The launch of a nanotechnology call for proposals in energy, environment, and ICT will be the first project.

Key Influencing Factors

Four strategic research areas have been defined within the federal S&T Strategy - From a knowledge perspective, the government will focus research on areas that are of national importance from both social and economic perspectives. The strategic areas that have been identified are:

- Environmental science and technologies,
- Natural resources and energy,
- Health and related life sciences and technologies, and
- Information and communication technologies

Future sustainable energy sources and the environment continue to be major national issues – Elimination of toxins from the environment and the production and use of cleaner, renewable and more efficient energy sources are issues of concern. A number of NRC research programs (e.g. ocean science, biotechnology, manufacturing, construction, aerospace, fuel cell and alternative energy technologies, chemical processes and environmental technology) focus on the physical environment and ways to reduce and reverse industrial and urban environmental impacts, as well as ways to accommodate changes in environmental loads resulting from climate variations on the built environment. The NRC Institute for Aerospace Research (NRC-IAR) applies its research programs in partnership with Canadian industry on the development of more fuel-efficient air and road transportation and in the development of more environmentally friendly

propulsion systems. The National Bioproducts Program, to be launched in collaboration with Agriculture and AgriFood Canada, will act as a catalyst to bring key stakeholders from government, industry and academia to work on projects such as: chemical and ethanol production from lignocellulosic materials derived from forestry waste and/or agricultural biomass; using biomass and municipal waste to produce energy and chemicals through anaerobic digestion and gasification; and improving Canada's capacity to produce biodiesel from various plant oils and algae.

Aerospace sector is strong with R&D investments growing - Aerospace remains one of Canada's most important advanced technology sectors, investing $1.7B in R&D on total revenues of $22.1B in 2006. Both of these figures show growth over the previous year, with R&D investments growing by over 40%. Over 80% of this revenue is from the civil aviation sector, and primarily in export, with nearly 80% of total revenues obtained from foreign customers. The global industry is shifting, with original equipment manufacturers (tier 1) integrating a larger number of smaller firms directly into their supply chains, requiring a greater responsibility for design and production risks for the smaller companies. NRC will continue to be an important player in this sector, working with companies, and undertaking relevant research that will result in a cleaner environment and more efficient manufacturing.

Drive for "green" materials and methods in a strong manufacturing sector – In 2006, Canada's manufacturing sector contributed 18% of GDP, 71% of total exports and represented 59% of private industrial R&D. In total, there are over 2 million manufacturing jobs, representing 15% of the Canadian workforce. Manufacturing is globalizing, with requirements for an accelerated rate of innovation and resulting shortened product life cycles. There are increasing cost pressures for inputs and declining prices for manufactured goods. Innovation is becoming an imperative for retaining and growing the global market share of manufactured goods, and "green" materials and methods are becoming highly valued.

Critical public concerns such as health and wellness, dealing with chronic and infectious diseases, developing more effective drug therapies, diagnostic tools and equipment, and improving and diversifying Canada's agriculture sector will be important drivers of direction in Life Sciences, Genomics and Health research – The global market for life sciences is estimated at $500 billion and is growing at 20% annually[1]. NRC will continue to build on its successes, such development of world's-first non-invasive test for colon cancer, and its meningitis C vaccine, to deliver important value to Canada and the world. NRC will also continue to provide the necessary R&D to develop a thriving Canadian nutraceutical industry.

ICT industry is an important economic engine for Canada that thrives on continued innovation – Canada is a significant player in the global ICT industry, with 32,000 ICT companies employing almost 590,000 skilled Canadian workers and generating over $136B in revenues. The communication equipment-manufacturing sector alone is the largest R&D spending industry, representing 10% of total R&D spending in Canada. Economic trends, including the appreciation of the Canadian dollar, nevertheless present challenges to the Canadian industry. Continued innovation therefore, particularly for the lower tier supply companies, will be important to maintain a leading edge globally. With three ICT-related institutes, NRC will be an important contributor to

[1]NRC Atlantic Initiatives: Building Technology Clusters, 2004. *Life Sciences* National Research Council Canada, p. 9

developments in this field.

Nanotechnology is a strategically important area of research for Canada with substantial potential application and economic value for Canadians – The rich diversity of invention enabled by nanotechnology will allow revolutionary developments in medicine, materials, pharmaceuticals, and electronics. The economic and social impact of nanotechnology has the potential to be profound: discoveries and applications of nanotechnology could lead to a new industrial revolution in the coming century, and to commercial markets as large as $1.5 trillion per year within 10-15 years. Nanotechnology is a fast-growing and revolutionary field in which Canada needs to build and sustain world leadership.

PLANNED STRATEGY

NRC will create value for Canada and build sustainability through focused research and development in areas critical to Canada's future: environmental science and technologies, natural resources and energy, health and related life sciences and technologies, and information and communication technologies. NRC will invest in leading edge research and related infrastructure, while facilitating increased horizontal and multi-disciplinary R&D.

PLANNING HIGHLIGHTS

Theme - Environmental science and technologies

Facilitate technology advantage for next generation aerospace industry – NRC-IAR's Aerospace Manufacturing Technology Centre was designed to support the complete aerospace manufacturing supply chain, from SMEs to large Aerospace firms, in the development and implementation of modern manufacturing methods with the potential of cost savings. With gas turbine use expected to grow dramatically, continued research into higher efficiencies (less greenhouse gas productions) and alternative fuels will be required. To facilitate this increased research effort, NCR-IAR is proposing to expand its Gas Turbine Laboratory facilities to accommodate the Alternative Fuels Facility for Research & Development (AFFORD). AFFORD would help develop technologies for a wide range of alternate fuels, including ethanol, biodiesel, syngas/hydrogen-enriched fuels, and coal liquefaction. With the shift in the global aerospace industry supply chain, Canadian SMEs must demonstrate strong design, production, and quality capabilities to retain and enhance their position in the global market. NRC-IAR will focus on supporting this industry segment to develop the R&D and knowledge capacity to compete.

Continue to support Canada's commitment to reduce green house gas emissions and improve the environment – A number of NRC research institutes and programs are applying their knowledge and competencies to challenges related to energy, the environment, and sustainable development to combat climate change. These research efforts include: NRC's Fuel Cell and Hydrogen Program, involving the NRC Institute for Fuel Cell Innovation (NRC-IFCI) and five other institutes; work on advanced materials and energy-efficient processes for manufacturing; the NRC Institute for Research in Construction (NRC-IRC) development of new materials for buildings and

construction; the application of biotechnology to the remediation of contaminated lands and water; and development of new infrastructure in support of the aerospace sector.

The success of the cross-NRC Fuel Cell and Hydrogen Program will be the foundation for a second national program currently in planning, as described further below. NRC will work with NRCan, NSERC and others to establish robust linkages within the fuel cell and hydrogen research "ecosystem". It is expected that Fuel Cells and Hydrogen will help Canada meet its priorities regarding sustainable energy and the environment.

Water assessment, analysis, and protection — Water will become the limiting resource for the 21st century and the NRC is at the forefront of R&D to assess and address water quality and quantity issues. The NRC Biotechnology Research Institute (NRC-BRI) utilizes biosensors, DNA microarrays, ecotoxicology, and trace-level analytical chemistry to analyze water and develop appropriate treatment systems. Work is also progressing on pollution prevention and water-use reduction strategies, through green technologies. Because groundwater is a major source of Canadian drinking water, NRC-BRI will focus primarily on aquifer testing and in-situ bioremediation.

The NRC-IRC Urban Infrastructure program is focusing its research and technology transfer efforts on cost-effective technologies to increase the durability of urban lifelines and to improve municipal asset management practices. In respect to water and the water delivery infrastructure, the program integrates laboratory and full-scale instrumentation, materials development and testing, and analytical and statistical modeling competencies in the areas of buried pipe performance, risk-based water quality performance and leak detection.

Build sustainability through oceans science – Canada's oceans are a strategic resource of prime importance to humanity, the environment, and industry. The NRC Institute for Ocean Technology (NRC-IOT) integrates advanced technologies to achieve innovative solutions to meet the challenges relating to safe and effective transportation, food production, energy development, recreation and information gathering on the oceans. In 2005, NRC-IRAP received two-year funding under the umbrella of the Oceans Action Plan (OAP) to contribute to networking efforts that promote oceans science and technology. This has led to the creation of the Ocean Science and Technology Partnership Organization (OPO), a federally incorporated not-for-profit entity that will encourage national linkages between regional oceans networks. Properly supported, these relationships will lead to increased and timely information sharing, awareness building and new technology demonstrations, partnerships and joint ventures.

Theme – Natural Resources and Energy

Support Canada's leadership in Fuel Cells – The cross-NRC Hydrogen and Fuel Cell program, in addition to being directly aligned to the new federal S&T Strategy, is well integrated and supportive of the industry cluster activities of NRC-IFCI for the Vancouver Fuel Cell cluster. It is also linked to NRCan, Industry Canada, DND and NSERC through the interdepartmental Hydrogen and Fuel Cell committee. Transfer of fundamental research results from the current program to companies is already underway. Signed collaborative projects between NRC and Canada's top three fuel cell companies (Ballard, Hydrogenics, and Tekion) all stem from research developed in the program.

Linked through the horizontal program, each participating institute works with regional R&D providers, universities, government agencies, and local industry to support the development of regional fuel cell clusters. In British Columbia, NRC-IFCI's Technology Centre and its Incubation/Acceleration and Networking Facility will provide a focus for SMEs' technology acceleration, integrated technology demonstrations, and industry-university-government partnerships. The NRC Institute for Chemical Process and Environmental Technology (NRC-ICPET) activities are helping to build significant fuel cell activity in Ontario through working with the Kingston-based Fuel Cell Research Centre, which brings together researchers at Queen's and other Ontario universities and Ontario firms such as DuPont and Hydrogenics.

Overall NRC will play a key role in fuel cell and hydrogen research through the development of next generation Polymer Electrolyte Membrane Fuel Cells (PEMFC) and Solid Oxide Fuel Cells (SOFC) aimed at reducing fuel cell costs and improving reliability and durability. Projects will focus on polymeric and ceramic materials for fuel cell applications, virtual engineering of fuel cells, novel fuel cell stack architecture, embedded sensors and supporting diagnostics, advanced nano-materials research for an intermediate temperature SOFC, high temperature PEMFC (both polymer and ceramic proton conducting) and electrocatalysis. Collaborations with NRC's Centre for Surface Transportation Technology will begin developing opportunities for the commercial application of fuel cells to military vehicles to meet the needs of the Canadian Armed Forces.

Building on the success of their complementary activities in Fuel Cells and Hydrogen research, development and demonstration, NRC, NRCan and NSERC have established a Tri-Partite Fuel Cell and Hydrogen R&D Committee to look at ways to coordinate federal government activities in this area. The Committee will also look at the opportunity to establish a National Program that would contribute to Canada's priorities in sustainable energy and environment by maintaining and strengthening Canada's leadership position in the supply of fuel cell and hydrogen technology. A strategic planning exercise will be launched this year and should be completed in time for a full launch of a National Program in the second year of planning.

Focused research on key needs within the Energy Sector – In its Strategic Plan, *Science at Work for Canada*, the NRC identified sustainable energy and the environment as top Canadian priorities. NRC's flagship investment in sustainable energy has been its cross-NRC fuel cell program, as described above. There is also a small but growing investment in the application of advanced materials and nanotechnology to renewable energy. To ensure that these energy investments are aimed at the most promising and crucial needs of Canada, NRC is creating a Sustainable Energy Committee that will bring together researchers from across the Council to advise NRC senior executives on energy positioning with respect to NRC's key sectors and the needs of the national programs. The committee will also ensure that NRC's efforts are aligned with other government departments, in particular the anticipated federal energy S&T strategy.

NRC will continue to participate in the Program for Energy Research and Development and the Climate Change Technology and Innovation. It will also contribute to the federal energy S&T strategy led by NRCan to ensure that its planned activities are aligned with federal priorities.

Integrate "green" materials and processes in advanced manufacturing to meet global market needs – To respond to global market needs and competition, all sectors require greater support for accelerating innovation, improving productivity, and integrating green materials and methods. This

is particularly important for the SME community. NRC-ICPET will continue to focus on two major research thrusts: energy-oriented processes and solution-driven materials, targeting applications in the oil sands, fuel cell, and bioproducts industries. NRC-IFCI will continue to focus on clean energy-oriented processes and solution driven novel materials, sensors and architectures, targeting applications in fuel cells and hydrogen and linking those to end users such as car manufacturers, utilities, oil industries, pulp and paper, mining, and forestry-bio fuels. The NRC Industrial Materials Institute (NRC-IMI) will continue to focus on the materials processing and forming industry, performing R&D and providing open laboratories and partnership opportunities to innovative companies. NRC-IAR's success in the area of aerospace manufacturing technology has led to a transition of these new technologies into the non-aerospace manufacturing sector.

Theme - Health and related life sciences and technologies

Multi-disciplinary health and wellness research – NRC's Genomics and Health Initiative (GHI) continues to invest in large-scale horizontal research programs focused on bringing the benefits of rapid advances in the genome sciences and/or health research to a variety of Canadian industrial sectors. This initiative supports multi-disciplinary research across several NRC institutes, as well as an impressive team of academic, clinical and industrial partners, in the development of biorenewable oil for food and fuel, a patient-specific virtual reality system for surgical oncology, biochips for diagnosis and understanding of human diseases, and the integration of imaging and diagnostic technologies to provide tools for better treatment and management of heart disease.

The NRC Institute for Biological Sciences continues to work to improve health and wellness of Canadians by discovering and translating novel solutions for preventing, diagnosing, and treating infectious and neurodegenerative diseases. It integrates its unique platforms in neurobiology, glycobiology, and immunobiology with those of other NRC institutes, in converging technologies (IT, nanotechnology, and material science) in areas of diagnostics, therapeutics, and vaccines.

Working to improve medical instrumentation and minimally invasive diagnostic techniques – The NRC Institute for Biodiagnostics (NRC-IBD) will continue to pursue research opportunities that support advancement of medical instrumentation. It develops both low field and high field Magnetic Resonance (MR) systems, and will continue working on gradient-free imaging technologies, which have the potential to revolutionize MR application. This technology could result in Magnetic Resonance Imaging (MRI) being deployed in situations that are not currently feasible, such as portable units. MR technology could become cost competitive with older X-Ray and CT technologies. NRC-IBD will also be focusing on the development of optical technologies for use in cardiovascular in-vivo medical intervention and surgical procedures. An additional area of development is in dental health, with a compact, handheld probe to detect incipient tooth decay, which when combined with remineralisation therapies, could change the paradigm of "drill and fill" for treatment of dental caries.

NRC-IBD is also developing new instrumental techniques and associated software, primarily based on MRI technology, which are minimally invasive. The objective is to transfer these techniques from laboratory to clinical use, and to support the Canadian medical device sector in this endeavour. Current projects include cancer detection (colon, head, neck, bile duct, pancreatic, breast, prostate, and brain), neuroscience (Alzheimer's disease epilepsy, brain injury, stroke, psychosis, and

childhood psychiatric diseases), cardiovascular disease (ischemia and infarction), as well as diabetes.

In addition, NRC-IMI is initiating several multi-institute health and wellness related projects funded by the Genomic and Health Initiative (GHI-4)

- Patient-Specific Virtual Reality Systems for Surgical Oncology
- Biochips for Understanding and Diagnosis of Human Disease
- Heart Disease: Better Tools for Better Treatment

Functional Foods and Nutraceuticals - NRC Institute for Marine Biosciences (NRC-IMB) will focus on the discovery and validation of bioactives for the benefit of the functional foods and nutraceutical industries, from commercially exploitable marine algae and animal species. To address the gap in identification and determination of health benefits of bioactives from natural sources, the NRC-INH continues to strengthen and expand its research capacity, network building, collaborative initiatives, and operating resources. It has built strong partnerships with Canadian clusters, Florida Atlantic University, and the medical chemistry team at Scripps Florida. NRC-INH is working to connect the PEI biocluster to a developing nutraceutical cluster in Kannapolis North Carolina, to facilitate international interaction. NRC Plant Biotechnology Institute (NRC-PBI) is working to enhance the innovative capacity and competitiveness of the Canadian plant-based natural health products industry by helping to support the creation of a world recognized industry in functional foods, natural health products and nutraceuticals.

Positively influence indoor conditions and health - NRC-IRC will continue to focus on three activities to positively influence indoor environmental conditions. One research activity, together with other provincial and government departments and the private sector, focuses on improving indoor air quality and health, including better selection of low-emitting, non-toxic building materials, and improved ventilation/heating regimes. A second activity focuses on establishing the necessary daily light dose in buildings for good physical health. The third activity is the development of the Building and Health Science Network, a community of Canadian researchers whose work touches on the effects of indoor environmental conditions on health and well-being. Results will be shared with the Canadian construction industry, health community, and Provincial/Territorial authorities to promote indoor health through design, construction, and operation of buildings.

Theme - Information and communications technologies

Reduce industry risks and costs of working on next generation information and communications technology – The new federal S&T Strategy recognizes the importance of enabling technologies, including ICT, nanotechnologies, and biotechnologies that underpin many of the most transformative advances in science and technology. NRC defines ICT as a subset of electronic systems, comprised of photonics, micro-electronics, software and wireless. Aside from being an industrial sector in its own right, ICT is a pervasive enabler, essential for applications ranging from medical sensing devices to data management products.

NRC currently has two "ICT focused" institutes, as well as ICT activities embedded in most of its major research programs. The NRC Institute for Information Technology's (NRC-IIT) emphasis is on extracting knowledge from data, improving the human-computer interface and developing e-

business solutions. The NRC Institute for Microstructural Sciences (NRC-IMS) strengths lie in device integration, modeling and simulation and the development of leading edge materials. In addition, NRC invests in forward-looking research that explores exciting new areas such as quantum computing that will fuel the information revolution of the next decade. Key areas of expertise across NRC include data mining, decision support systems, sensor networks, device technologies (including sensor development), visualization, and quantum theory.

For the planning period, NRC aims to address the needs of Canadian firms by collaboratively creating with industry the convergent platform technologies that will ensure global competitiveness for the future. NRC will identify and build capability in gap areas deemed important by industry and other stakeholders and will continue to develop "ahead of the curve" technologies that can bring Canada to the forefront of this dynamic sector. As the first step in implementation, NRC will launch a collaborative project in sensor networks involving the competencies of multiple institutes.

A renewed MOU to facilitate research collaborations between NRC and the Communications Research Centre Canada (CRC) is also under negotiation, and will support implementation of NRC's ICT Sector Strategy. As part of this, mechanisms to promote additional activities, including an annual workshop, are being considered.

Speech Security Projects - NRC-IRC is collaborating in several projects with the RCMP and PWGSC concerning the design and assessment of the speech security of meeting rooms. The idea is to determine whether an eavesdropper can hear or understand speech from an adjacent meeting room where confidential material is being discussed. The work involves both physical measurements and subjective listening tests. New procedures have been developed to predict the likelihood of a security lapse from measurements or predictions of the acoustical characteristics of the meeting rooms. A better understanding of the factors influencing people's ability to understand low levels of speech in noise has been achieved and work is underway to complete a speech privacy guide and have the new procedures adopted into measurement standards.

Theme – Leading edge multi-sector research

Integrate nanotechnology research and innovation – NRC will continue to help Canada stake its place in nanotechnology through its research in applications for medical devices, electronics, fuel cells and construction materials, and through the continued development of the NINT – a multi-disciplinary institute formed through partnership with the University of Alberta and the Province of Alberta.

NINT research competencies often serve several application themes and have been developed to serve four major areas of application; selected due to their importance and strategic emphasis by both NRC and the Government of Alberta. These areas are: Energy, Life Sciences-Human Health, Life Sciences- Agriculture, Food and Forestry, and Information and Communications Technology. NINT's mission is to create knowledge and support innovation in select areas of nanoscale science and technology that will have long-term relevance and lasting value for Alberta and Canada as a whole.

NRC's nanotechnology research is targeted at three main application areas that directly impact Canadian competitiveness: new materials and coatings; quantum devices for next generation

computing and communications; and novel nanostructure devices for photonic, sensing, and biological applications. This research spans twelve NRC research institutes and combines a spectrum of competencies ranging from the fundamental understanding of the properties of nanostructures, through the manufacturing of nanomaterials and nanodevices. To build its competencies and leverage its resources and knowledge, NRC has launched a horizontal nanotechnology initiative, NRC-Nano. Through this program, NRC will further promote collaborative efforts aimed at nanotechnology applications in aerospace, construction, communications and health related industries. For example, the NRC Steacie Institute for Molecular Sciences (NRC-SIMS) collaborates with NRC-IRC and NRC-IAR in the development of new nanotechnology-based composite materials offering significant improvements in applications for the aerospace and construction sectors. It is also expected that the program will not only increase Canadian capacity in nanotechnology, but will also prove to be a training ground for young researchers entering this important new sector.

With the successful launch of NRC-Nano, and the completion of the basic "building blocks" of NINT (construction of the state-of-the-art nanotechnology facility and staffing the research program), NRC will take a leadership role in building a concerted nanotechnology effort across the country. This process will bring together the major players in Canada and should build consensus on the road ahead for the country. NRC will be working with its Albertan partners, NanoQuebec, and a number of NRC institutes, including the NRC Industrial Materials Institute in Boucherville. There is also work underway with national and international bodies on nanotechnology standards, coordinated at NRC by its NRC Institute for National Measurement Standards. This work will also build on NRC's partnership with NSERC and BDC on nanotechnology. It will be a key effort in helping Canada achieve the aims of the federal S&T Strategy, which recognizes the importance of this emerging field.

Support Canada's long term competitiveness through the adoption and mutual recognition of international standards – The NRC has long held a mandate for measurement standards, a sometimes invisible element of scientific infrastructure that supports regulations, technology development and manufacturing, and international trade. The *NRC Act* specifically mentions the traditional physical measurements, but increasingly other fields of science are looking to establish measurement standards, including chemistry, biology and more recently nanotechnology. At the same time, physical measurement standards have not remained static, and it is anticipated that they will provide the foundation to enable progress in emerging areas such as nanotechnology. Another area is time: fifty years ago, when the first cesium clocks were developed as a measurement standard, it was not anticipated that today they would be a key element in the provision of GPS services. Scientists are unable to predict exactly how the next generation of clocks will influence society, but it is likely that they too will spur another high technology industry.

Recognizing the importance of measurement standards to industry and the economy, our trading partners around the world are gearing up for this new era in metrology, investing in new state-of-the-art facilities and in advanced research in measurement science. With over 35% of Canadian GDP directly dependent on exports, it is crucial that Canada too invest in its essential metrology infrastructure.

The NRC Institute for National Measurement Standards (NRC-INMS) has the mandate for measurement standards. NRC-INMS will continue to play a vital role in assuring global market

access to Canadian industry by reducing non-tariff trade barriers, and will work internationally, particularly with the Security and Prosperity Partnership with Mexico and the U.S., toward establishing mutual recognition of standards for testing and measurement in key sectors, such as the automotive and chemical sectors. NRC will contribute to the development of regulatory standards for nanotechnology and other emerging technologies. Canada's participation in establishing the initial standards for emerging technologies will provide a competitive edge to innovative Canadian firms, providing them with early access to state of the art international standards for effective participation in global markets.

NRC is currently looking at its research in measurement science across its institutes, with the aim of integrating its activities and creating new areas of synergy. This new program, NRC Measurement Science, will be launched FY 2008/09 to respond to measurement barriers to innovation identified in national, key industry sector and cross-NRC programs, thus contributing to the delivery of the strategy.

One initial promising area is nanometrology, particularly with the new nanoscience investment at the NINT. NRC will be investing in a new multi-institute project in nanometrology under its new NRC Nano program that will develop methodology and tools to improve accuracy of nanoscale dimensional measurements and the reproducibility of fabrication of nanoscale devices. These basic methods and techniques are required to support commercialization of the innovations resulting from nanoscience discoveries, as well as to avoid adverse effects on human health and the environment.

Leverage "Big Science" partnerships – TRIUMF (Tri-University Meson Facility) is one of Canada's key investments in large-scale research infrastructure. It provides world-class facilities for research in sub-atomic physics, including nuclear physics, nuclear astrophysics, particle physics, life sciences and condensed matter, and encourages the transfer of technology developed at the laboratory to the marketplace as well as other forms of economic and societal benefits. NRC provides funding for the facility on behalf of the Government of Canada via a contribution agreement. In terms of technology transfer, TRIUMF, in collaboration with MDS Nordion, will continue to generate cyclotron-produced medical radioisotopes for over two million clinical treatments in North America during 2008. TRIUMF has a 2005-2010 Plan, with five-year funding totaling $222 million, and is actively preparing its next Plan for the period 2010-2015.

Facilitate the implementation of Canada's Long Range Plan for Astronomy and Astrophysics (LRP) – The NRC Herzberg Institute of Astrophysics (NRC-HIA) executes the mandate assigned in the *NRC Act* to "operate and administer any astronomical observatories established or maintained by the Government of Canada". The federal S&T Strategy directs focus in areas to help Canada create Knowledge, Entrepreneurial and People Advantages, and astronomy is an important area. Canadian industry is the world leader in observatory construction and is building expertise in high-technology telescope instrumentation, both of which are directly related to the integrative approach promoted by NRC. NRC brings research, technologies and industrial links together in delivering its mandate to provide access to international S&T infrastructures to the Canadian astronomy research community. Research and knowledge transfer from astronomy and astrophysics also provides social and economic benefits in far-ranging areas, from MRI in the health sector, to remote sensing, to advances in telecommunications.

Canada's Long Range Plan for Astronomy (LRP) is a comprehensive 10 year strategy that will take Canadian astronomy into a new era of large "world observatories". The astronomy community has identified four major projects; next generation observatories that typically take fifteen to twenty years to move from concept to operation. Working closely with Canadian universities, NSERC, the Canadian Space Agency (CSA) and the Association of Canadian Universities for Research in Astronomy (ACURA), as well as industry partners, NRC-HIA plays a major role in delivering a number of projects under the LRP. These include the Atacama Large Millimeter Array (ALMA), and early phase work for the two longer-term projects, the Thirty Metre Telescope and the Square Kilometre Array. NRC-HIA will continue to lead the scientific team on the James Webb Space Telescope (JWST), a space-based observatory for which CSA is coordinating the Canadian contribution. A new agreement was signed in 2006 with CSA to support the development of specialized instrumentation for this facility, including ongoing work on a cryogenic test unit.

Support horizontal and multi-disciplinary collaborations in energy, environment and health – NRC is working with Agriculture and Agri-Food Canada to launch a National Bioproducts Program which will consist of several large-scale multi-disciplinary, multiparty (including government, academia and university) projects which will be focused on addressing key Canadian priorities: sustainable energy; the environment, and rural revitalization. More specifically projects will focus on:

- biomaterials, which will provide environmentally friendly products for the automotive, aerospace, construction, and plastics industries;
- chemical and ethanol production from lignocellulosic materials derived from forestry waste and/or agricultural biomass;
- use of biomass and municipal waste to produce energy and chemicals through anaerobic digestion and gasification;
- improvement of Canada's capacity to produce biodiesel from various plant oils and algae

The McGill University Health Centre (MUHC) and its affiliated institutions and collaborators signed an agreement with NRC-BRI to create and expand the existing model of the NRC-BRI Accelerator Project. This joint collaboration between NRC-BRI and MUHC, which takes advantage of the combination of clinical research and health R&D conducted at NRC-BRI, will funnel external funding to support the valuation and technology transfer process; identify and prioritize the best potential innovations from both NCR-BRI and MUHC; offer project management for selected technologies; incubate and accelerate the development of technologies; and ultimately facilitate the transfer of technologies to the private sector or create spin-off companies to exploit such Intellectual Property (IP). This project will speed the translation of innovation from bench to bedside to business and thus accelerate value creation from excellence of the research conducted in both institutions.

Work with partners in industry and academia to enable leading edge materials research – The Canadian Neutron Beam Centre (CNBC), part of the NRC-SIMS, provides national facility access to neutron scattering for materials research to a wide range of Canadian and international academic, government and industry users. Canada enjoys a global leadership position (including a Nobel Prize) in this field, which supports the aerospace, automotive, rail and electronics sectors. The Centre is one of about 20 similar neutron scattering facilities worldwide and a key part of Canada's science infrastructure. The value of the CNBC to the Canadian academic community was reinforced in the recent NSERC Major Resources Support (MRS) program in which the Canadian Institute for Neutron Scattering, CNBC's largest client, received a significant increase in support

(from $1M in 2007 to $1.22M in 2008 increasing to $1.41M in 2012). This is the largest MRS grant given by NSERC (about 30 % of the total MRS budget).

Neutron beams are a unique source of very valuable data about materials and contribute to advances in physics, chemistry, life sciences, materials research, and engineering. Research undertaken at the CNBC has resulted in many benefits to Canadians positively impacting amongst other things, health and the economy, industrial competitiveness, and Canada's nuclear energy industry. Over the planning period, CNBC will be focusing on applying new neutron beam methods to soft materials and nanostructures. In addition, a new, specialized spectrometer being installed this year promises to make significant contributions to hydrogen research by enabling the study of new hydrogen storage materials.

Multi-disciplinary research partnerships to support the Northern Strategy – NRC has established a horizontal working group across its institutes to determine how NRC will best contribute to the Government's Northern Strategy and in particular the newly proposed Arctic research station. The October 2007 Speech from the Throne (SFT) committed the federal government to build a world-class Arctic research station that will be on the cutting edge of Arctic issues, including environmental science and resource development. NRC will work closely with Indian and Northern Affairs Canada (the lead department for the Northern Strategy) and other federal departments and agencies to establish Canada as a global leader on Arctic science. NRC has long been engaged in leading-edge science with Arctic implications including the bioremediation of contaminated sites, research in construction, ships in ice and Arctic oil, gas exploration, emergency evacuation from offshore northern structures, ice forecasting and iceberg drift predictions.

Support to National Security – NRC-INMS is participating in an ongoing collaboration with the Canadian Food Inspection Agency, Defence Research and Development Canada (DRDC) and Ionalytics Corporation to develop analytical methodology for the rapid and highly sensitive detection of chemical warfare agents, toxic agrochemicals and toxins. The combination of instrumentation and procedures will provide Canada with unique capability and capacity to address chemical terrorist threats. The project will be completed in 2009. Other forms of collaboration include teaming with government departments and academia to contribute to Canada's security and counter-terrorism efforts through the Chemical, Biological, Radiological, or Nuclear Research and Technology Initiative (CRTI).

Priority 2: Community Technology Clustering Initiatives

NRC's technology cluster initiatives are an example of a partnership approach that supports the federal S&T Strategy, through accelerating the commercialization of new technologies, products, processes and services, and by building S&T capacity in key sectors and regions. The initiatives work with universities and colleges to build *Knowledge Advantage* through coordinated, leading edge R&D programs. Technology cluster initiatives support *Entrepreneurial Advantage* by enabling industry to translate new knowledge into products, processes and services. These initiatives also

work with partners to build *People Advantage* by attracting new PhD's to the regions, supporting joint-hiring and cross-appointing of researchers to both local universities and NRC, and providing hands-on training for students, and newly skilled expertise for our Canadian SME's.

Nations around the world have recognized the central role of science and technology in addressing the challenge to competitiveness and productivity caused by the advent of globalization. Many countries have recognized the importance and potential of technology clusters. Technology clustering initiatives explore new models for federal investment in R&D facilitating the integration of key players in communities across the Canadian innovation system, and they focus on S&T that addresses social and economic concerns of Canadians. Technology clustering is one of the best strategies for accelerating economic growth and global competitiveness.

Canada's private sector is dominated by SMEs, of which 98% have fewer than 100 employees. Within this context, Canadian SMEs often lack the capacity to invest in innovation to take full advantage of the outsourcing and off shoring realities of globalization, and realize the opportunity that would make them key players internationally. Clusters are broadly based community partnerships that focus on achieving competitiveness for Canadian industry and, as such, are an appropriate mechanism to encourage SMEs to invest together and share risks in pre-competitive R&D. Technology cluster initiatives encourage collaboration between industry, the higher education sector, and all levels of governments to facilitate the development of highly qualified people (HQP), and to accelerate the translation of new knowledge into products, processes and services. This, in turn, attracts talent, entrepreneurs and investment to cluster regions. As critical mass develops, clusters become self-reinforcing.

NRC supports each cluster's strengths by integrating its unique mix of resources (research, technology development, specialized information, seed financing, commercialization support, networks and expertise, international presence) with those of industry, government and higher education institutions to create a proxy for the critical mass required by SMEs. Better outcomes can be achieved through technology cluster initiatives and business networks that aim to boost the innovative capacity of firms via strategically focused partnerships between business, academic, community-based and government sectors.

Clustering is recognized as a long-term process and generally requires 10-20 years for maturation and achievement of full results. NRC's technology cluster initiatives are consistent with this paradigm, utilizing a phased development process. The first phase is focused on establishing specialized R&D capacity for industry, attracting HQP and integrating partners. The second phase concentrates on collaborative R&D, increasing private sector involvement, attracting investment, comprehensive integration of community players, and technology transfer and commercialization. Future phases are tailored to individual circumstances and progress, and commercialization is a central theme.

NRC is committed to fostering the growth of community-based technology clusters across Canada. It has cluster initiatives in 11 communities each at different stages of cluster life cycle development. This signature program delivers on NRC's commitment to contribute to the global competitiveness of Canadian industry in key sectors and to the economic viability of communities. In response to the economic challenges noted above, the Government of Canada has injected staggered investments of more than $500 million in NRC's 11 cluster initiatives since 1999-2000. Currently funding cycles

for the three separate rounds are being aligned so that funding for all initiatives will expire March 31, 2010. In 2009-2010, NRC intends to seek policy approval and funding for a national program of cluster initiatives. Table 1-7 provides a list of NRC's cluster initiatives, their latest funding cycles and financial resource allocations.

Table 1-7: Allocation of Resources for NRC Technology Cluster Development

Location	Focus	($ Millions)
2005-2006 to 2009-2010		
Halifax, NS	Life Sciences (NRC-IMB and NRC-IBD)	19.5
Fredericton and Moncton, NB	Information Technology and e-Business	48.0
St. John's, NF	Ocean Technologies	16.0
Atlantic Canada	Coordination, administration, special studies, innovation assistance, S&T knowledge,/ information dissemination	26.5
2007-2008 to 2009-2010		
Saguenay-Lac-Saint-Jean, QC	Aluminium Transformation	27.1
Ottawa, ON	Photonics	22.3
Winnipeg, MB	Biomedical Technologies	5.7
Saskatoon, SK	Plants for Health and Wellness	5.0
Edmonton, AB	Nanotechnology	34.6
Vancouver, BC	Fuel Cells and Hydrogen Technologies	13.6

Key Influencing Factors

The federal S&T Strategy highlights the creation of an Entrepreneurial Advantage for Canadians – Technology clusters support this element of the new federal S&T Strategy, through integration of industry, government, and university activities in research, talent development, knowledge transfer, and commercialization. The cluster initiatives increase the impact of the federal government's research investment, leveraging the resources and talent of key players across the Canadian innovation system. The mix of these resources creates a proxy for the critical mass required by SMEs to be able to participate and benefit from substantial R&D programs.

NRC is actively supporting the Government of Canada's commitment to improving Canada's productivity and competitiveness through community-based technology cluster initiatives – NRC's technology clustering activities build on existing local strengths by: undertaking R&D that responds to cluster needs; collaborating with partners (particularly firms); fostering networking; and providing industry with access to pre-commercialization assistance, such as incubation opportunities and financial and technical advisory services.

Development of sustainable technology clusters requires attraction and retention of sustained resources from key cluster stakeholders – Dynamic technology clusters require specialized infrastructure, highly-qualified people, risk capital, and the ongoing and active support of local stakeholders to sustain growth and generate economic and social benefits for Canadian

communities.

NRC is committed to continuous improvement in the management of its cluster initiatives and in encouraging their success – Ongoing measurement and evaluation of NRC's technology cluster initiatives provides NRC with insight into the performance of the initiatives, changes in the clusters, and their ongoing evolution.

PLANNED STRATEGY

NRC will contribute to the economic viability of Canada's communities, focusing on cluster growth to create critical mass and build community innovation capacity. It will do this by connecting industry and key innovation players, facilitating regional delivery of national initiatives.

PLANNING HIGHLIGHTS

The following are examples of cluster initiatives and related work that NRC intends to move forward:

Nanotechnology (Alberta) – The goal of NINT is to deliver nanotechnology applications in areas that can create and grow a sustained cluster of high technology industries that will deliver social and economic benefits to Alberta and to Canada. The main focus of NINT's research is the integration of nano-scale devices and materials into complex nanosystems that are connected to the outside world. The long-term objective is to discover "design rules" for nanotechnology, and to develop platforms for building nanosystems and materials that can be constructed for specific applications. NINT will be a key participant in the planned cross-NRC program on nanotechnology, and in particular, will work with NRC-INMS on measurement science in support of nanometrology. NINT will continue to work with nanoMEMS Edmonton and Tec Edmonton to bring together local proponents, and accelerate the growth of nanotechnology by attracting firms and investment to the region. The NINT building includes incubation space for companies. Capacity in packaging and assembly, and market-facing product development was identified as a critical need for the region, and both NINT and NRC-IRAP will continue to be involved in the development of the proposal for the Alberta Centre for Advanced MicroNanoTechnology Products (ACAMP).

NRC is partnering with NSERC and BDC in a joint call for proposals for nanotechnology driven research focusing on three of the federal S&T Strategy priorities – energy, the environment, and information and communications technologies. This initiative will see a total investment of $12M over the next three years to fund large-scale application-oriented research designed to take advantage of the nanotechnology knowledge and resources available in NRC Institutes, Canadian universities, and other cluster partners.

Biosciences (PEI) – Since 2003, through working closely with the PEI biosciences cluster, NRC-INH has helped to double the number of biotechnology companies in PEI (20 to 40). The numbers of biotechnology jobs have grown by approximately 55% (from approximately 450 to 700 FTEs) and sector revenues by 50% ($41M to $62M). NRC-INH has been involved in three successful Atlantic Canada Innovation files (Chemaphor, Phycobiologics and ACBV), which helped secure three new

companies into the cluster and over $13M in additional funding over a 5-year period. NRC will continue supporting this cluster through its stages of development.

Plants for Health and Wellness (Saskatchewan) - Focusing on plant product development and commercialization for health and wellness NRC-PBI is helping to build a natural health products industry and contributing to the global competitiveness of an emerging and important Canadian industry. In the coming year, NRC-PBI will be focusing in three areas: implementing technology road-mapping and competitive intelligence to strategically position products evolving from previous and continuing research; building receptor capacity in this industry so that its firms are capable of achieving successful commercialization leading to sustainable growth; and, establishing key partnerships with Saskatoon, western Canada and pan Canadian institutions and organizations for shared action and investment. NRC will work in partnership with Ag-West Bio Inc. and Saskatchewan Industry and Resources to attract key companies and business investment to the cluster.

Sustainable Infrastructure (Saskatchewan) - The sustainable infrastructure cluster initiative in Regina is helping NRC fulfill its commitment to translate science and technology into social and economic well-being for Canada and to contribute to the economic viability of Canada's communities. Cluster partners are working to transform a collection of regional firms, research partners and organizations into a cohesive technology cluster, in which shared know-how and innovative solutions result in industry growth, increased export opportunities and sustainable regional wealth and quality of life. Regina is home to a very active community-based organization, Communities of Tomorrow, Partners for Sustainability Inc. (CT), that facilitates collaboration between firms, supporting organisations, and research-based organizations.

The focus of NRC Centre for Sustainable Infrastructure Research (NRC-CSIR) is on water and wastewater infrastructure, including performance of water mains, failure mechanisms, life-cycle management and risk-based decision making. NRC-CSIR research aims to develop innovative methods to reduce the risks, costs, and resources needed to build and maintain these assets, while increasing their performance and value and thus, their contribution to the social, economic and environmental welfare of our communities. Among several projects, NRC-CSIR plans to assess and the long term performance of Asbestos Cement Pipe in North America and provide a guidance document for sustainable management of these assets in partnership with 19 utilities and municipalities in North America.

Support network of Industrial Partnership Facilities (IPFs) – In support of its cluster development activities, NRC will continue to develop and operate Industry Partnership Facilities across Canada. These unique facilities are workplaces for collaborative research and the incubation of new firms and NRC spin-offs. They also serve as community resources for access to mentoring, innovation financing and competitive technical intelligence for new enterprises. Currently, NRC has 18 IPF locations across the country with a complement of 116 incubating firms. This brings the total space available in IPFs to approximately 30,000 square metres.

Build on successes from NRC's Atlantic Initiatives, Phase I – NRC will continue to nurture the growth of its Atlantic cluster initiatives by maintaining leading-edge research capabilities (infrastructure and human capital), developing research collaborations with cluster firms, fostering

increased networking and knowledge-sharing, and supporting the involvement of firms and other partners in the cluster.

- **Information Technology (New Brunswick)** – NRC-IIT is continuing to be a key provider of innovation infrastructure and programs to bridge R&D to innovative New Brunswick products. One key initiative is the Cancer Populomix Institute, a collaboration of UNB, Université de Moncton, the New Brunswick Innovation Foundation, the Beauséjour Medical Research Institute, Dalhousie University, and NRC-IIT. The aim of this collaborative group is to advance research for the prevention and early detection of cancer. NRC-IIT is contributing to the undertaking through the development of tools that will assist in the analysis of DNA microarray data. This technique for tumour classification and analysis may lead to dramatic improvements in cancer detection and treatment regimes, and shows potential for application across a spectrum of disease issues.

- **Ocean Technologies (Newfoundland and Labrador)** – NRC-IOT will continue to lead the ocean technology cluster-building process by working with industry, government and academia. Building on Atlantic Investment Partnership (AIP) funding, NRC-IOT has opened the Ocean Technology Enterprise Centre (OTEC), a hub designed to bring together key services (SME partners, NRC-IRAP, NRC-CISTI and cluster initiatives) to produce new economic development endeavours and support ocean technology company growth. NRC-IOT will also work with Ocean Advance to develop and implement a community-wide action plan.

- **Life Sciences (Nova Scotia)** – In 2005-2006 NRC-IMB partnered with BioNova, the Nova Scotia biotechnology industry association, InnovaCorp (a provincial economic development organization), Nova Scotia Office of Economic Development, Atlantic Canada Opportunities Agency, and Nova Scotia Business Inc. to facilitate the development of a roadmap for the revitalization of the cluster. Stage one of the process, the Asset Map, has been completed and the request for proposal for stage two is in preparation. The Atlantic Commercialization Centre (ACC), located in the IPF, provides an integrated approach to NRC's presence in the community. Through ACC programs, a new collaboration with a local public life sciences company, MedMira, has been initiated and is geared towards discovery and commercialization of breast cancer biomarkers. The Industry Partnership Facility currently houses eight organizations.

  NRC-IBD (Atlantic) working in collaboration with the QEII hospital, is seeking funds from a number of federal sources to expand its current facility and build an adjoining Clinical NeuroSciences (CNS) Centre. An essential component of this expansion will focus on increasing its neurological diagnostic capability to include magnetoencephalography (MEG). In addition NRC-IBD (Atlantic) has established a multi-user MRI laboratory in the Izaak Walton Killam (IWK) Health Centre, which houses two research MRI/S instruments for the study of animal models of disease. Studies are already currently underway in molecular imaging, drug development, and biomaterial characterization.

Encourage more involvement / commitment of cluster partners – During the planning period, NRC will continue to build upon existing successes, such as:

- **Biomedical Technologies (Manitoba)** - The rapidly growing NRC-IBD spin-off company Innovative Magnetic Resonance Imaging Systems (IMRIS) is but one example of a success in Manitoba's biomedical cluster. Several US hospitals with the IMRIS equipment have been advertising the value of the instrument very aggressively, including a live web cast of a neurosurgery using the device at the Boston Children's hospital. In 2007, NRC received a commitment from the federal government of approximately $5.7M to continue their biomedical cluster development in Winnipeg. In the coming years, they will concentrate on operationalizing the Centre for the Commercialization of Biomedical Technologies; developing a Researcher in Residence program for cluster organizations; linking the cluster with other clusters nationally and globally; establishing SME commercialization and growth services; disseminating medical technology bulletins; and deploying competitive technical intelligence services In addition, NRC-IBD will implement development strategies to enhance the cluster and position it for growth from the current "developing" phase to the "established" phase.

- **The NRC Canadian Photonics Fabrication Centre (NRC-CPFC) (Ontario)** –a partnership among the NRC, the Province of Ontario, and Carleton University was officially opened in 2005, filling an important gap in the photonics community by providing not only fabrication and prototyping services, but also expertise and advice through the NRC-IMS. NRC-CPFC is the only industrial fabrication facility for photonics components in Canada, and one of the few in the world. NRC-CPFC not only extends its services to the local SMEs that have emerged in the wake of large private sector high tech lab closures, but to firms and photonics clusters across Canada. NRC-CPFC's services substantially reduce start-up and production development costs, helping to reduce technology risk for Canadian firms, and mitigating investment risk to support venture capital investment. A technology road-mapping exercise is planned with clients and partners to determine which other platforms should be selected for NRC-CPFC's future directions.

Support for all Canadian technology clusters – NRC-IRAP has been involved in the early recognition and support for more than 50 technology clusters in Canada. NRC-IRAP's products and services are equally relevant to *groups* of SMEs as they are to individual firms. NRC-IRAP continues to engage and link regional groups as part of developing the technical, financial and business networks vital to cluster development. To foster specific cluster development, NRC-IRAP will take on a leadership role in collaborating and developing integration between regional players in order to strengthen the required integrated regional innovation infrastructure. NRC-IRAP will also directly impact firm growth within the cluster by providing non-repayable contributions on a cost-sharing basis for their technological research projects.

Cluster efforts are proactive. Benefits are intended to accrue to all players within the cluster supply chain with a support plan targeted to the specific needs and stage of the development of the cluster. This is not dependent on one organization's readiness to increase its technical capabilities.

NRC-IRAP staff will continue to work closely with NRC's 19 research institutes, two technology centres and NRC-Canada Institute for Scientific and Technology Information (NRC-CISTI) to increase the numbers of SMEs engaged in NRC cluster activity, as well as attracting other

innovation support organizations to provide services to all organizations within specific clusters. In various clusters, NRC-CISTI has established NRC Information Centres (NIC), co-located at NRC institutes. NICs offer scientific, technical, medical, and business-related information and analysis services to NRC researchers, companies located onsite, and external clients in the region. NRC-CISTI will partner with institute outreach activities to promote and deliver an integrated package of services to regional clientele.

Priority 3: TIS Technology and Industry Support - Integrated Industry Support that Engages Key Players

One of the pillars of the federal S&T Strategy is creating an Entrepreneurial Advantage for Canada. NRC will actively support this policy imperative through linking key industry players to provide innovation capacity to the SME community, where much of the entrepreneurial activity occurs within the country. Through the commercialization process, SMEs also need assistance in managing the risks associated with R&D and new product development. NRC will focus on supporting this community throughout the commercialization process.

In Canada, the majority of firms are SMEs, which do not always have the resources or the capacity to either develop their own or contract out significant R&D projects. With its industrially-focused technology support, NRC's role becomes even more important. For the planning period, NRC will build upon its critical mass and expertise in key technologies, knowledge transfer mechanisms, business support facilities and services across Canada to strengthen innovation and growth in Canadian businesses. It will also continue to develop strategic initiatives to help Canadian businesses better compete in the global marketplace.

Key Influencing Factors

Increasing pressure on Canada's competitiveness from the forces of globalization –This pressure has made innovation an imperative for economic survival. In 2006, Canada's ratio of Gross Expenditures in Research and Development (GERD) to Gross Domestic Product (GDP) rose to 1.94%[2] from 1.91% in 2005 but fell short of the Organisation for Economic Co-operation and Development (OECD) average of 2.3%[3]. Although Canada's Business Enterprise Research and Development spending (BERD) did rise by 7.2% to $14.8 billion in 2006, as a percentage of GDP at 1.03% it fell short of the OECD average of 1.53% as well as falling short of its peak in 2001 of 1.31% of Canadian GDP. With a relatively lesser investment compared to other countries, NRC will be an important enabler for focused S&T efforts, and helping ensure that businesses have the support they need to succeed and drive further investment.

[2] Estimates of Canadian Research and Development Expenditure (GERD), Canada, 1995 to 2006 Science, Innovation and Electronic Information Division Catalogue no. 88F0006XIE — No. 009

[3] OECD, Main Science and Tech y Indicators (MSTI), Volume 2007/2

The federal S&T Strategy includes a commitment to enhance support for business R&D and encourage public-private partnerships – NRC-IRAP and other government agencies were specifically mentioned as champions and drivers of this initiative to increase investment in the development of new technologies and their introduction into the market. Furthermore, the federal S&T Strategy identified the need for federal science-based departments to more closely align priorities to increase commercialization outcomes, and enhance domestic and international partnerships.

Canada's two million SMEs are the key drivers of job and wealth creation in all sectors of the Canadian economy – Ninety-eight percent of Canadian firms are SMEs, with 75% having fewer than 10 employees. Large firms account for approximately 60% of private sector R&D expenditures, with SMEs performing the remainder.[4] Spending on innovation by smaller firms represents approximately 5.8% of revenues, versus 2.1% reported by large companies. However, SMEs are struggling to survive and grow as approximately 20% exit in the first year and over 40% exit the market after two years [5] Interestingly, high-knowledge firms experience faster growth and tend to have a survival rate higher than do low-knowledge firms.[6] Canadian wealth generation is dependent on SMEs ability to access, develop and exploit new knowledge and technologies

SMEs face many barriers in their quest for commercial success – There is now a fundamental shift in how firms generate new ideas and bring them to market. In today's connected world, the commercialization challenge is not simply one of producing the best product. Entrepreneurs and innovative firms require certain business expertise, and experience to complement their knowledge, intelligence, and skills, sometimes even before they recognize their importance. Continued support of SMEs is essential to building Canadian industrial innovation and growth. The following list describes many of the common barriers faced by SMEs:

- Low levels of private sector R&D investment leads to lagging productivity and competitiveness.
- Lack of scale results in problems accessing the capital markets, including venture capital, especially with early stage R&D.
- Difficulty in accessing new technologies (96% are developed outside of Canada) and lack of awareness and/or time to link to solutions and sources of assistance.
- Thinking and acting globally from the start.
- Failure of managers to communicate well the investment potential of their firm to financial institutions.
- Lack of awareness or involvement in networks/clusters – important engines of growth since they encourage innovation and collaboration.

[4] 2006 Statistics Canada Business Register

[5] SME and Entrepreneurship Outlook, Organization for Economic Co-operation and Development (OECD), 2005 and Statistics Canada, Longitudinal Employment Analysis Program (LEAP) Data, 2005

[6] Business Dynamics in Canada, 2006, Statistics Canada, (high knowledge industry is defined as high R&D and capital intensive)

PLANNED STRATEGY

NRC will provide integrated and comprehensive support to increase the innovative capacity of SMEs. This encompasses S&T information and intelligence, commercialization support around technology transfer and IP management, including helping to manage risks as new products are developed and marketed.

PLANNING HIGHLIGHTS

Build innovation capacity within SMEs – NRC-IRAP is NRC's innovation and technology assistance program that supports Canadian SMEs. Since its inception close to 60 years ago, the program has broadened its strategic purpose from a limited focus on technology transfer to its current strategic objective of increasing the innovative capabilities of Canadian SMEs. Today, NRC-IRAP provides comprehensive innovation assistance to technology-based SMEs in almost every industrial sector of importance to Canada's current and future economic development. SMEs engaging in high-risk, technologically sophisticated R&D face increasingly complex challenges. In the next three years, NRC-IRAP will strengthen its program in a systematic manner, enabling it to enhance its services in areas such as:

- facilitating multi-stakeholder collaborations;
- forging stronger links for technology based SMEs to access publicly-funded research and sources of technology; and
- supporting SME efforts to access foreign technology and form international alliances.

Over the next three years, the NRC-IRAP will target the following activities that form, in part, responses to recommendations stemming from a recent evaluation of the program:

- increasing the number of funded clients by 25-30% over FY 06/07 levels;
- increasing the annual contributions expenditures by $20M over FY 06/07 levels;
- simplifying the program delivery processes and procedures;
- enhancing the working relationships with NRC Institutes and Branches;
- increasing the collection and usage of performance management data.

NRC-IRAP has also established SME focused Sector Teams (ST) to complement existing industry sector initiatives and establish alignment with NRC's key sector strategy – in aerospace, manufacturing and materials, construction, information communications technologies and bioproducts.

Enhance collaborative partnerships - NRC will increase its efforts to develop collaborations and partnerships with industry and engage stakeholders to contribute to the development of clusters across Canada. NRC-IRAP's involvement will increase significantly in Phase 2 of a cluster's lifecycle. NRC-IRAP will become a key integrator and attractor, and will bring synergy to the clusters. NRC-IRAP's approach to building and supporting technology clusters differs from, and builds on, its usual method of reacting to a specific firm need. Its cluster approach is community-based, not firm-based; proactive, not reactive; benefits are intended to accrue to all players within the cluster supply chain, not just one firm; and support is targeted to the specific needs of the cluster's stage of development, not on one organization's readiness.

Scientific and Technical Information – The NRC-CISTI is Canada's national science library, and the largest comprehensive source of scientific, technical and medical (STM) information in North America. Through its publishing arm, NRC Research Press, NRC-CISTI is also Canada's foremost scientific publisher. NRC-CISTI's information specialists, technical business analysts and technical information analysts provide value-added information services and competitive technical intelligence reports to NRC-IRAP SMEs, NRC researchers, and other clients through the NRC Information Centers co-located with NRC institutes across Canada.

NRC-CISTI will be undertaking a number of activities to support implementation of the NRC Strategy, including:

- strengthening and aligning the Collection resources to meet the emerging research and commercialization information needs of sector and national program initiatives related to the NRC Strategy;
- developing publishing projects (conference proceedings, etc.) to disseminate research;
- providing bioproduct article aggregations (and the equivalent for other research areas);
- developing a new open access bioproducts journal to disseminate this research and give NRC a higher profile;
- enhancing support for commercialization of research by providing information intelligence services to sectors, cross-NRC programs, and national programs; and,
- developing web portals to support specific collaborative research areas (e.g. nanotechnology).

In the digital age, fast, seamless access to quality, up-to-date information is vitally important to the S&T research, health, corporate and industrial sectors of the economy. A direction that reflects NRC-CISTI's national mandate is to collaborate to develop components of the scientific information infrastructure, or "infostructure", to connect STM communities and content repositories in order to provide equitable access to STM information and knowledge discovery tools.

NRC-CISTI will partner to develop:

- digital content repositories (an NRC institutional repository - *NRC Publications Archive* and a national *PubMed Central International Canada*);
- networked approaches to give Canadian knowledge workers in the public and private sector desktop access to STM content (*Federal Science eLibrary*, *National Libraries for Health Virtual Health Library*);
- tools and services to support research and publishing (*NRC RP Scholarly Publishing Digital Platform*, knowledge discovery tools, information literacy training);
- portal development (web portals to NRC program and collaborative initiatives); and,
- best practices in data management, national standards for metadata and agreement on applications of these within the research library network.

Information access and delivery to SMEs – Over the years, NRC has determined that staff networking is an excellent vehicle for sharing expertise, relevant information, and access to specialized resources within the SME domain. NRC-IRAP works closely with NRC Institutes to bring the benefit of Institute knowledge and expertise to SMEs. NRC-IRAP supports the work of Institutes through contribution agreements with SME clients, and will continue to proactively engage Institutes for the knowledge and information benefits to SMEs.

Build on the success of the Competitive Technical Intelligence (CTI) program – NRC-IRAP and NRC-CISTI will continue to develop CTI services in order to provide best-in-class strategic advice to Atlantic cluster participants and optimize NRC investments. For example, NRC-IRAP and NRC-CISTI have added a Technical Business Analyst presence in St. John's NL and are integrating CTI advice into NRC-IRAP's portfolio of services to Atlantic and Nunavut firms. NRC-CISTI and NRC-IRAP are also working together to provide CTI to SMEs in other parts of Canada, including Montreal, Winnipeg and Edmonton. NRC-IRAP has developed an in-house capability to capture CTI, and as a next step, will integrate this information into the strategic planning and business strategies of client firms within key NRC sectors.

Provide support to identify successful commercialization opportunities – Scientific research and technology commercialization are high cost investments with high risks. Commercialization costs can be 10 to 100 times the cost of technology development, with less than a 5% success rate.[7] Support must be available to assess all success factors, including market potential, production costs, and ongoing development needs. NRC-CISTI has targeted these needs and developed expertise in delivering information and intelligence to NRC programs, clients and partners.

Offer comprehensive commercialization support, including technology transfer and Intellectual Property management. During 2006-07, NRC undertook an in-depth examination of all its industry support programs, policies and practices as part of a project called Business Review. This Business Review project was launched to ensure NRC was well-equipped and well-positioned to carry out client based activities described in NRC's Strategy, Science at Work for Canada. Recommendations from the Business Review project include: working increasingly on an industry-sector basis; increasing NRC's capacity to develop industrially relevant technologies and their commercialization; and ensuring NRC's internal operations make it easier for our Institutes and Programs to serve clients. In response to the Business Review, the newly created Central Business Support will provide the specialized services and expertise that NRC Institutes, Cross-NRC initiatives and programs require to carry out business activities in support of the NRC Strategy.

Continue to improve NRC's Intellectual Property Management: Guided both by a 2003 benchmarking study of best practices in Intellectual Property (IP) management, and the results of the Business Review project, NRC will continue to strengthen its IP management. Specific activities will include: increased focus on high value IP; increased use of technology assessments; increased market research tools; and adoption of the world's best practices and tools. As well, NRC's corporate business office will undertake an innovative invention disclosure review process that promises to provide better guidance to institutes. This process will also engage the breadth of NRC's Technology and Industry Support expertise and seek opportunities for technology bundling and convergence.

[7] Reamer, Icerman and Youtie, 2003

Priority 4: Program Management for a Sustainable & Agile Organization

The ability to perform at the leading-edge of R&D and to support Canadian industry in becoming more technology intensive and innovation-driven requires the best available equipment, facilities and highly qualified scientists, engineers, technicians and other professionals. As a result, NRC is continuously refining its strategies to attract, develop and retain highly qualified personnel as well as to ensure the creation and maintenance of world class physical and IT infrastructure.

The Corporate Branches of NRC, specializing in finance, information management, human resources, administrative services and property management, provide policy, program advice and executive support for the coordination and direction of NRC's operations and the NRC Council. Effectiveness and efficiency in program management, positions the operational areas of NRC to deliver results with impact to be aligned with the federal S&T Strategy.

Key Influencing Factors

Taking action to be a more flexible, adaptable organization – NRC's Strategy recognizes that to be successful NRC must be able to make timely decisions in order to respond quickly and appropriately to constantly changing external opportunities, challenges and risks. Through putting in place the necessary tools, management frameworks and systems NRC will strengthen and better integrate its financial, planning, risk and performance management capabilities to support effective decision-making and priority-setting by Senior Management and NRC institutes, programs and branches.

Need to attract, develop, and retain highly qualified personnel – A recently conducted NRC-wide environmental scan identified several implications for NRC in relation to talent attraction, management and retention. This scan confirmed that in the coming years, Canada will be faced with shortages of highly skilled workers in all areas of the economy. It also confirmed the need for greater interdisciplinary collaboration within the S&T community, increased organizational capacity and increased employee engagement. As such, hiring, developing, motivating and compensating highly qualified people in a highly competitive and collaborative work environment will be a key challenge for NRC. While much of the projected shortages of skilled labour are based on low birth rates and real and projected shortages of graduates from Canadian and American universities, much of the shortage of skilled workers will be as a result of the aging population and the associated anticipated wave of retirements which will take place over the next 5-10 years. Projections indicate that in 2011, the aging population will accelerate with the first Boomers reaching age 65. Approximately 25% of NRC's S&T professionals and 39% of NRC's management cadre will be eligible for retirement in 2011. It is therefore imperative that over the next few years, NRC focuses on attracting and retaining our critical workforce and on developing appropriate succession planning strategies.

Need for increasing horizontal S&T linkages among S&T-based departments and agencies, as well as partnerships with other innovation players – As indicated in the federal S&T Strategy, the federal government is committed to increasing the impacts of federal investments in S&T by, amongst other things, enhancing collaborations within the federal S&T community and fostering deeper research and commercialization partnerships with other innovation system players including universities and colleges, and the private sector.

Addressing significant budget pressures around NRC's on-going operations, buildings and equipment – As part of the implementation of its strategy, NRC will need to formulate a long-term financial plan to deal with significant pressures. Such pressures have resulted from an imbalance between available operational and capital funding, and ever-increasing facilities and equipment needs. The rapid pace and evolution of S&T, higher industry standards and the natural ageing of our infrastructure have been the main drivers behind these growing needs. A Long-Term Capital Plan will be developed, looking at the challenges of maintaining and repairing 186 buildings across the country, 60% of which were constructed over 30 years ago. Furthermore, NRC continues to address significantly rising energy costs. Despite a number of innovative measures to achieve energy savings, these costs have risen from $19 million in 1998-99 to $32.25 million in 2004-05. A sound financial strategy is an essential cornerstone of NRC's immediate and long-term capacity to contribute to Canada's productivity, standard of living and other key national priorities. Priority-setting and resource allocation decisions will be central to this strategy.

Information Technology infrastructure to facilitate leading-edge science – Researchers at NRC and elsewhere are demanding greater processing power in terms of High Performance Computing, increased bandwidth in communications networks, specialized workstations with vast processing power and huge storage capacity. IT (hardware and software) is evolving very rapidly and these changes are expected to accelerate during the coming years. This will require NRC to adopt new technologies, upgrade to newer versions of software, replace obsolete technologies and to upgrade NRC's IT infrastructure (e.g., IT security infrastructure, Local Area Network (LAN) infrastructure, collaborative tools and the Corporate Messaging system). In this regard, NRC needs to take steps to strengthen its technology foresight function, in order to support the NRC Strategy of building a sustainable and agile NRC.

Addressing recommendations made by the Office of the Auditor General of Canada and Management Accountability Framework commitments – The OAG notes NRC's good progress in addressing the recommendations of its 2004 audit while acknowledging that the process of consultation and development of the NRC Strategy has not allowed NRC to move as quickly as possible on some. With the new Strategy and corporate business plan now in place, all responses to the recommendations are either completed or on-track.

PLANNED STRATEGY

NRC will be a sustainable and agile national research and innovation organization for Canada. As it continues to implement its Strategy to 2011, it will move forward with established priorities to help ensure sustainability, clear and consistent corporate direction and relevant program support to

achieve its goals in alignment with federal S&T priorities. It will additionally continue to address its accountability commitments and recommendations of the Auditor General of Canada.

PLANNING HIGHLIGHTS

Key projects supporting the implementation of NRC's Strategy include:

- **Annual NRC corporate business plan** – NRC's Strategy, *Science at Work for Canada*, will continue to be implemented over the planning period. The strategy, which is consistent with the federal S&T Strategy released in mid 2007, will help shape NRC's research direction and areas of industry focus through 2011 and beyond. Key implementation activities under the NRC strategy are discussed each year by the Senior Executive, at a priority-setting retreat. The outcomes of this annual retreat shape the contents of the annual corporate business plan, which is generally released in the first quarter of the fiscal year. The business plan guides NRC's operational activities during the planning period, to support implementation of the NRC Strategy.

- **An integrated solution to planning, risk and performance management** – In 2008/09, NRC will continue with implementing an integrated management framework in order to provide senior management and NRC Institutes, Programs and Branches with the planning, financial and performance information which they need to support integrated decision-making, resource allocation and functional planning (human resources, capital assets and finance) in support of strategy execution. This framework aims to embed modern management practices in the planning and performance management process (e.g. risk and research management) and minimize the reporting burden (one-pass planning and reporting). This integrated management framework was formally launched across NRC in 2007/08, and will be refined in 2008/09.

  Building on the successes of the integrated planning, risk and performance management solution, an integrated NRC project team comprised of members from finance, human resources and corporate services has been formed to put in place the tools, management frameworks and systems by 2010 for effectively managing NRC to achieve the strategy. The work of this project team is expected to continue through 2010. As part of this project, NRC will update its Program Activity Architecture (PAA) to ensure it reflects the organization's strategic direction and management of resources.

- **Governance and accountability structures** – A key strategy in the Human Resources Branch Business Plan is to assist NRC in defining and developing governance and accountability structures for key sectors, national programs and cross-NRC initiatives. The Human Resources Branch will build on a recent study of organizational design issues and principles and will define and develop an implementation plan related to governance and accountability. Key desired outcomes in 2008-2009 include the identification of HR management practices, tools, and processes required to implement a new governance and accountability structure. We will define HR policy standards and rewrite HR policies in order to support the organization's new strategy and structure.

Strategies for sustainable resources – Faced with ongoing resource pressures, NRC will need to make more strategic choices regarding the use of future resources. This will involve:

- **Addressing funding issues** – NRC will continue to set priorities for key R&D and technology and industry support activities, initiatives and programs in the context of the organization's strategy. It will also produce strategies and mechanisms for ongoing reallocation and conduct efficiency improvement reviews to ensure effective investment of resources for sustainability in priority areas.

- **Talent attraction, management and retention** – The Human Resources Branch recently completed an environmental scan and subsequently prepared an associated Business Plan for 2008-2011. Flowing from this business plan, the Human Resources Branch will develop strategies designed to attract, retain, and manage NRC's talented workforce over the next three years and in the years ahead.

  In 2008-2009, NRC will engage in several activities related to talent attraction and retention. Emphasis will be on succession planning, both corporately and at the local level. NRC will also revise internal mobility practices with a view to enhancing the ability of staff in critical workforce segments to move more easily throughout the organization. In addition, NRC will define its compensation philosophy and review and revise the promotion criteria used for Research Officers and Research Council Officers to better reflect the NRC Strategy. In 2008-2009, a needs and gap analysis will be conducted, relating to talent attraction, to initiate the development of a talent attraction strategy, for implementation in the following year. Finally, NRC will review its practices respecting rewards and recognition and commence development of a comprehensive rewards and recognition program.

  Regarding talent management, in 2008-2009 NRC will develop an Employee Performance Management Framework. NRC will also focus effort to create a Management Training Roadmap and to launch the first module of a Management Training Program, to complement the early successes of the Leadership Development program. Another key activity will be the completion of a learning needs assessment and the development of an NRC-wide learning strategy to address priority needs. Finally, the NRC will develop a workplace assessment method, along with accompanying tools and processes, to assist senior managers in assessing such issues as talent management, organizational performance and employee satisfaction for particular workplace units or teams.

- **Maintaining and upgrading NRC S&T infrastructure** – NRC has commissioned for all institutes, a Facility Condition Assessment (FCA) which will provide the current condition of the facility and identify the level of investment required over a 25-year period to keep the facility in an acceptable condition. The FCA will form the basis for NRC's Long Term Capital Plan, which will guide NRC investments on the necessary infrastructure modifications and upgrades to address rust-out concerns, as well as address specific research program requirements. Projects with a health and safety component will be the top priority, followed by those that address life cycle management.

- **Addressing audit recommendations on NRC's Environmental Program** – An audit conducted by the OAG of NRC's Environmental Program resulted in recommendations that

require implementation of revised, more rigorous processes and procedures. In response NRC will be establishing an Environmental Management System (EMS) to guide facility operations and environmental activities in order to support sustainable development at NRC.

- **Developing three-year NRC Communications Outlook** – NRC has developed a 3-year rolling strategy (to be updated annually) for communications, corporate marketing and corporate relations – along with sub-component operational plans (web, internal, external, media, and corporate initiatives support). It addresses recommendations from a comprehensive NRC Communications Situation Assessment and extensive consultations with NRC executive and Council members. These exercises were undertaken to align and position NRC's communications function, organization, structure and resources in support of NRC's Business Strategy and Plan imperatives as well as relevant Government of Canada priorities (e.g. the federal S&T Strategy *Mobilizing S&T to Canada's Advantage*).

  The NRC communications strategy positions, profiles and promotes NRC's unique contributions to national S&T and innovation priorities in support of industry, as well as the creation of true economic value and social benefits for Canada and all Canadians. Complementary communications models, strategies, plans and programs will be developed for NRC national programs, horizontal initiatives, cluster initiatives, key sector initiatives, resource attraction and other efforts. The overall communications approach will support both the federal S&T Strategy and NRC's Business Strategy. Finally, NRC will develop and implement a strategy to guide NRC internal communications, with particular focus on supporting the implementation of NRC's business strategy.

  In addition, NRC will continue its involvement in interdepartmental and government-wide horizontal S&T and innovation initiatives, including the upcoming North American Platform Program (NAPP), the S&T Integration Board Communications Committee and the Government of Canada S&T web portal.

- **Ensuring effective IT management** - NRC will be considering a number of new initiatives to support implementation of the Strategy (e.g., Client Relationship Management System; SAP upgrades; IT security architecture). It will also be undertaking a major review of its information technology activities and IT governance structure across the organization. This third-party review will span the balance of FY 2007-08 and the first two quarters of FY 2008-09, with two key objectives: 1) benchmarking NRC's IT expenditures against a peer group of international R&D-intensive organizations; and 2) analysis of NRC's cost-effectiveness in managing its IT infrastructure and services, leading to recommendations for changing certain aspects of NRC's current federated IT service model. These results are expected to feed into improvements for greater overall efficiency of IT management at NRC.

Support implementation of the federal S&T Strategy – NRC is actively involved in the interdepartmental effort to implement the new federal S&T Strategy. In 2008-09, NRC will continue to participate on the ADM Committee on S&T, the whole-of-government coordinating committee on S&T which is responsible for coordinating implementation of the federal S&T Strategy and monitoring progress. NRC is also a member of the Director General-level sub-committee that has been established by the ADM Committee on S&T to provide support on these matters and is an

active participant in the sub-committee's activities, including co-leading two of the working groups that are addressing implementation of specific horizontal commitments in the Strategy.

As well, NRC will continue to participate on the ADM S&T Integration Board (IB) and its related task groups to address both priority issues where S&T contributes to the solution, and to resolve common management issues, such as human resource challenges and financial barriers to collaboration.

Implementation of management action plans: Office of the Auditor General 2007 Follow-Up Audit to the 2004 Audit Management of Leading-Edge Research – The NRC will continue to implement the management action plans developed to address the recommendations of the OAG from its follow-up audit in the areas of corporate governance, setting of corporate strategic direction, research management at the institute level, human resources management and performance measurement and reporting. Overall, all plans are on track and those for corporate governance have been completed. Progress along with activities completed will be reported in NRC's Departmental Performance Report. During this RPP planning period, NRC will continue to implement any outstanding items from its response to OAG recommendations:

OAG Recommendations	NRC Response
Setting of Corporate Strategic Direction	• NRC will review the overall implementation of the corporate business plan and NRC Strategy, course correcting where necessary. • NRC will continue to monitor its implementation for important milestones and risks.
Research Management at Institute Level	• NRC has launched an intranet site which includes a section on Management of Research and Technology, providing resources and information on project management, R&D portfolio management and project selection. NRC will continue using this vehicle as a forum for sharing best practices in these areas across the NRC Institutes. • The intranet site also contains a Research Management Self-Assessment (RMSA) toolkit. This tool will continue to be promoted to the broader institute community to improve internal research management practices.
Human Resources Management	• NRC will integrate compensation, rewards, promotions, awards and other forms of recognition, recruitment, succession planning, and performance planning with the strategic priorities of the NRC Strategy. This will be done via NRC's business planning process. A human resources plan will be developed by March 2008 with input from institutes/programs and branches, capturing the key human resources requirements to deliver on NRC's strategic priorities. This will feed into the development of NRC's Corporate Business Plan for 2008/09
Performance Measurement and Reporting	• The NRC Balanced Scorecard was approved by the Senior Executive Committee in September, 2007. The Balanced Scorecard is aligned with the NRC Strategy and the corporate business plan. An interim data collection protocol is currently under development for implementation in 2008-2009. • The submission of the Management, Resources and Results Structure (MRRS) framework update will be submitted to TBS by March 2008. The associated performance management and governance frameworks are also scheduled to be submitted to TBS for March 2008.

SECTION II – ANALYSIS OF PROGRAM ACTIVITIES

This section provides an overview of NRC's Program Activities and how they will be contributing to the organization's priorities and strategic outcome. NRC Program Activities include Research and Development and Technology and Industry Support. These provide a balance between conducting R&D and delivering technical and innovation support services to industry and the public.

Strategic Outcome

An innovative, knowledge-based economy for Canada through research and development, technology commercialization and industry support

Program Activity: Research and Development

This program activity includes research programs, technology development initiatives and management of national science and engineering facilities. These efforts all focus on key technological and industrial areas of Canada's economy where NRC has specific roles and recognized competencies, and where it can have a significant impact.

Table 2-1

Financial Resources ($ millions)		
2008-2009	**2009-2010**	**2010-2011**
478.0	474.9	396.0

Table 2-2

Human Resources (FTEs)		
2008-2009	**2009-2010**	**2010-2011**
3,408	3,412	3,034

Program Activity: Technology and Industry Support

This program activity includes dissemination of scientific, technical and medical information; provision of innovation assistance and engineering and technology-based facilities; contributions to the commercialization process; intellectual property management; new company creation and strategic partnerships for Canadian SMEs, NRC institutes, the public and other government research organizations.

Table 2-3

Financial Resources ($ millions)		
2008-2009	**2009-2010**	**2010-2011**
222.4	217.3	209.9

Table 2-4

Human Resources (FTEs)		
2008-2009	**2009-2010**	**2010-2011**
923	881	859

Priority 1: R&D in Key Sectors and Areas Critical to Canada's Future	
Key contributor	Program Activity: Research and Development
Planned Strategy	NRC will create value for Canada and build sustainability through focused research and development in areas critical to Canada's future: environmental science and technologies, natural resources and energy, health and related life sciences and technologies, and information and communication technologies. NRC will invest in leading edge research and related infrastructure, while facilitating increased horizontal and multi-disciplinary R&D.
Expected results/Outcome	• Excellence and leadership in research that benefits Canadians • Contribution to federal strategies and initiatives • Collaborative research with other innovation players nationally and internationally
Performance Indicators	The following performance indicators will be focused on activities within key sectors: • IP portfolio (patents issued, patent applications, licences) • Publications in refereed journals / proceedings and technical reports • Leadership and contribution to federal horizontal initiatives • Number and value of national and international collaborative agreements

Priority 2: Community Technology Clustering Initiatives	
Key Contributors	Program Activity: Research and Development Program Activity: Technology and Industry Support (NRC-IRAP and NRC-CISTI)
Planned Strategy	NRC will contribute to the economic viability of Canada's communities, focusing on cluster growth to create critical mass and build community innovation capacity. It will do this by connecting industry and key innovation players, facilitating regional delivery of national initiatives.
Expected results/Outcome	• Community ownership of the cluster – local leadership and strategies • Greater productivity and increased new technology-based solutions • Competitive research and development base in cluster communities
Performance Indicators	• IPF occupancy rate for cluster initiatives • Access and use of NRC-IRAP and NRC-CISTI by cluster actors • Technology transfer to cluster actors (number and value of collaborative agreements, joint patent applications, licensing)

Priority 3: Integrated Industry Support that Engages Key Players	
Key Contributor	Program Activity: Technology and Industry Support
Planned Strategy	NRC will provide integrated and comprehensive support to increase the innovative capacity of small and medium-sized enterprises (SMEs). This encompasses S&T information and intelligence, commercialization support around technology transfer and IP management including helping to manage risks as new products are developed and marketed.

Expected results/Outcome	• Improved dissemination of knowledge • Enhanced innovation capacity of firms • Supporting Canadian industry and advancement of new technology-based companies
Performance Indicators	• Access and use of technology and industry support provided by NRC to SMEs • Client satisfaction • Highly qualified engineers and scientists to SME clients • Linkages with innovation partners (co-location of ITAs, Competitive Intelligence Services)

Priority 4: Program Management for a Sustainable Organization	
Key Contributor	NRC-Wide Contribution[8]: Program Activity: Research and Development Program Activity: Technology and Industry Support
Planned Strategy	NRC will be a sustainable and agile national research and innovation organization for Canada. As it continues to implement of its Strategy to 2011, it will move forward with established priorities to help ensure sustainability, clear and consistent corporate direction, and relevant program support to achieve its goals in alignment with federal S&T priorities. It will additionally continue to address its accountability commitments and recommendations of the Auditor General of Canada.
Expected results/Outcome	• Progress towards delivery of NRC strategy aligned with federal priorities • Sustained, effective corporate governance and decision-making • Long-term stability of financial, human and capital resources • Effective research management • Effective communications with NRC stakeholders
Performance Indicators	• HR turnover rates • Percentage of operating budget allocated to training • Capital investment in infrastructure • Progress on strategy implementation • Net cash flow (see Statement of Operations) • Diversity/O/L statistics

[8] *(NRC's Corporate Branches actively support the Program Activities' contributions to this priority. The Corporate Branches provide policy, program advice and executive support for the coordination and direction of NRC's operations and the NRC Council. They also specialize in finance, information management, human resources, administrative services, property management and corporate services.)

NRC's Link to the Government of Canada Outcome Areas

NRC has a long history of making valuable scientific discoveries that strengthen Canadian industry and contribute to the well being of Canadians and others worldwide. NRC's priorities for 2008-2009 support two main Government of Canada priorities as outlined below.

A Sustainable Economy

Global leadership in science and technology, education and commercialization are the cornerstones to achieving a sustainable economy. Through its dedication to excellence in research and development and its focus on technology cluster growth, knowledge transfer and the development of outstanding people through education and training, NRC is a key contributor to a sustainable, innovative and prosperous economy.

Canada's Place in the World

Canada seeks to play a major role in meeting the economic, health, environmental and security challenges facing the world. NRC supports all of these goals –combining leading-edge research in key areas such as genomics, health, sustainable technologies and the environment with a strong focus on global reach and international research collaborations. The aim is to develop scientific and technological advances needed to enhance the quality of life of Canadians and others around the globe.

The Government of Canada

NRC contributes to the Government of Canada's desired outcomes of strong economic growth, an innovative and knowledge based economy, and a clean and healthy

NRC's Strategic Outcome

An innovative, knowledge based economy for Canada through research and development, technology commercialization and industry support

NRC's Priorities: 2008-2009 to 2010-2011

1. R&D in Key Sectors and Areas Critical to Canada's Future	2. Community Technology Clustering Initiatives	3. Integrated Industry Support that Engages Key Players
NRC will create value for Canada and build sustainability through focused research and development in areas critical to Canada's future: environmental science and technologies, natural resources and energy, health and related life sciences and technologies, and information and communication technologies. NCR will invest in leading edge research and related infrastructure, while facilitating increased horizontal and multi-disciplinary R&D.	NRC will contribute to the economic viability of Canada's communities, focusing on cluster growth to create critical mass and build community innovation capacity. It will do this by connecting industry and key innovation players, facilitating regional delivery of national initiatives.	NRC will provide integrated and comprehensive support to increase the innovative capacity of small and medium sized enterprises (SMEs). This encompasses S&T information and intelligence, commercialization support around technology transfer and IP management, including helping to manage risks as new products are developed and marketed.

4. Program Management for a Sustainable & Agile Organization

NRC will be a sustainable and agile national research and innovation organization for Canada. As it continues to implement of its Strategy to 2011, it will move forward with established priorities to help ensure sustainability, clear and consistent corporate direction and relevant program support to achieve its goals in alignment with federal S&T priorities. It will additionally continue to address its accountability commitments and recommendations of the Auditor General of Canada

Table 3-1: Departmental links to the Government of Canada Outcomes

Strategic Outcome: An innovative, knowledge-based economy for Canada through research and development, technology commercialization and industry support					
		Planned Spending			**Alignment to Government of Canada Outcome Area**
Program Activity	**Expected Results**	**2008–2009**	**2009–2010**	**2010–2011**	
Research and Development	• Excellence and leadership in research that benefits Canadians • Contribution to federal strategies and initiatives • Collaborative research with other innovation players nationally and internationally • Greater productivity and increased new technology-based solutions	478.0	474.9	396.0	A Sustainable Economy Canada's Place in the World
Technology and Industry Support	• Improved dissemination of knowledge • Enhanced innovation capacity of firms • Supporting Canadian industry and advancement of new technology-based companies	222.4	217.3	209.9	A Sustainable Economy Canada's Place in the World

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